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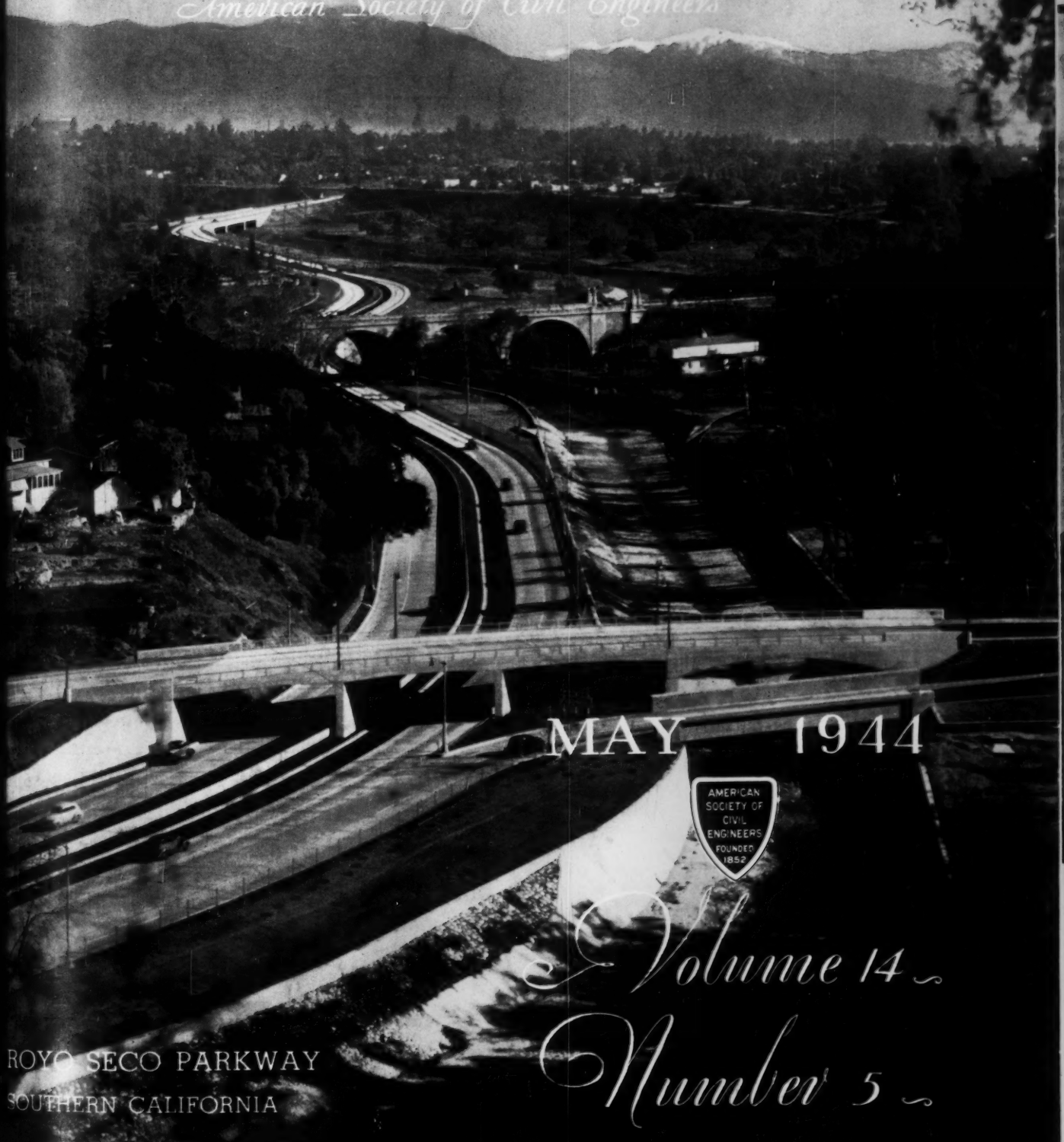


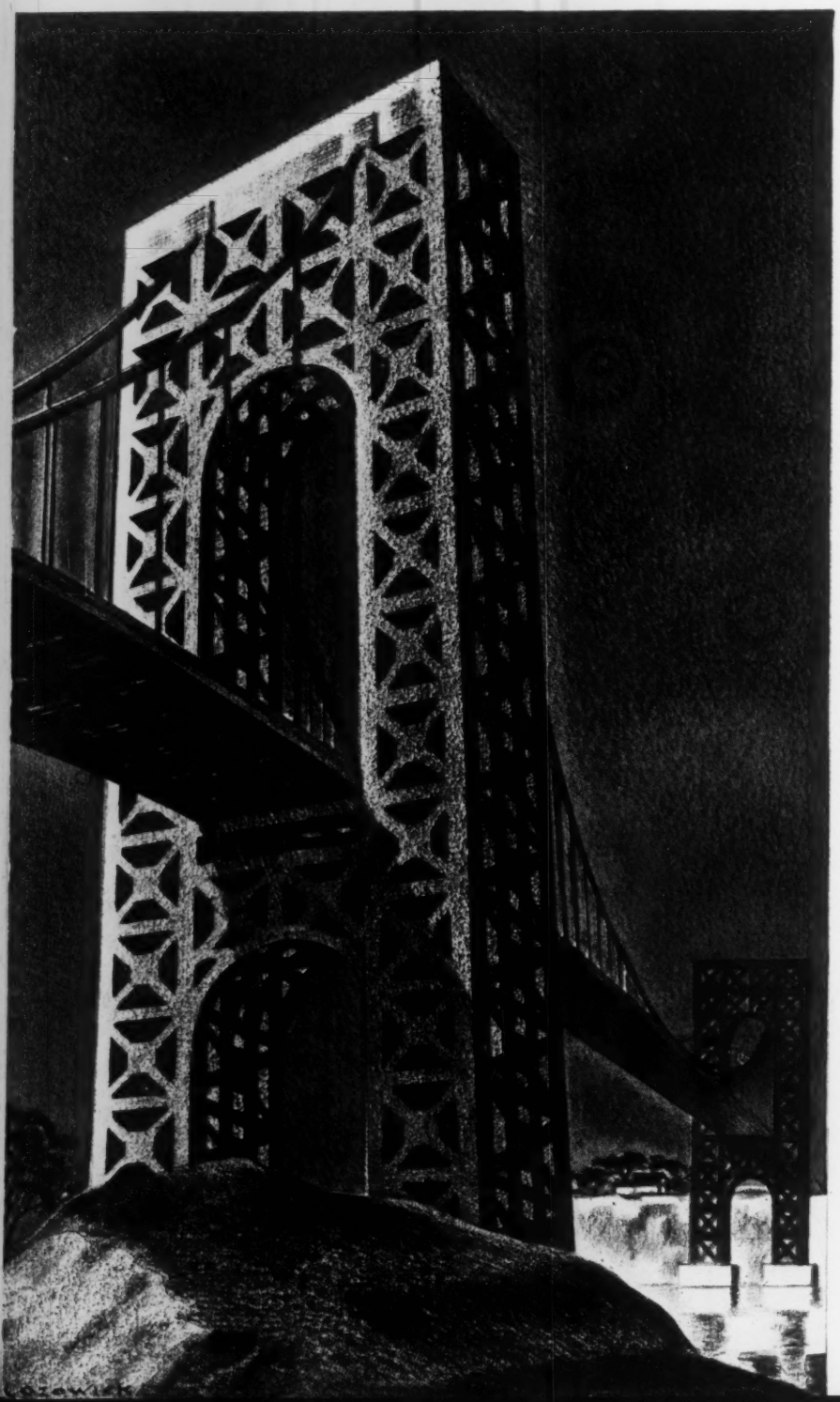
MAY 1944

AMERICAN SOCIETY OF CIVIL ENGINEERS FOUNDED 1852

Volume 14
Number 5

ROYO SECO PARKWAY
SOUTHERN CALIFORNIA

...FOR THE BRIDGES TO BE CROSSED TOMORROW



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Among Our Writers

J. Stanton Robbins (Yale, '24) organized the first "student-third" trip to Europe, which marked the transformation of the old-time steerage into tourist class. As a travel bureau executive he has traveled widely. He has represented the Office of Inter-American Affairs in Mexico City, and, as special assistant of the Coordinator of Inter-American Affairs, has made frequent trips by plane to Latin American republics.

Richard H. Gould (M.I.T. '11) for the past 15 years has been identified with the program for sewage disposal in New York City in the capacities of Chief Engineer, Acting Deputy Commissioner, and more recently as Director of Engineering in the Dept. of Public Works, in charge of the design program for public buildings, bridges, and sewage disposal. He was formerly in consulting work on water supply and sewerage.

Thomas H. MacDonald (Iowa State College, B.S. in C.E. '04) in 1906 became highway engineer with Iowa's first highway commission, and in 1915 chief engineer. Under his leadership, Iowa built up one of the best highway systems in the U.S. His achievements since 1919, as chief of the U.S. Bureau of Public Roads (now Public Roads Administration), have given him an international reputation.

S. C. Hulse since graduation (Cornell, '02) has devoted himself to construction work, specializing in dams and hydraulics, with a partiality for grouting and foundations. Field work has carried him from the East to the Rockies and beyond. In addition, several years in Latin America have given him an international outlook. He now makes his home in Bedford, Pa.

H. Alden Foster has had extensive experience during the past 25 years on the design and construction of bridges, industrial plants, hydroelectric plants, and general hydraulic construction. He was Chief of Engineering Design of the New York World's Fair. His experience on bridge foundations dates from the construction of the Arlington Memorial Bridge in Washington, D.C., in 1926.

Alfred Jones (Purdue U., '09) after railroad experience, in 1912 entered the employ of the County Surveyor of Los Angeles County as draftsman. In 1934, he became County Surveyor, and since 1937 has been both County Surveyor and County Engineer.

Guy Kelcey (Carnegie Inst. of Tech., '14) has engaged in highway traffic and transportation work since the last war, in which he was a U.S. Army air pilot. He served as Regional Director, Division of Local Transport, ODT, Southeastern States, 1942–1943. Recently he joined the staff of the Port of New York Authority as Highway Analyst.

Max K. Socha (U. of Calif.) has been with the City of Los Angeles, Dept. of Water and Power, for the past 20 years, engaged in general engineering, structural, architectural, and hydraulic design. From 1935 to 1941 he was Administrative Coordinator of PWA and WPA projects and also Contract Operating Engineer for the Water System. Since 1941 he has been Assistant Engineer of Design for the Water System.

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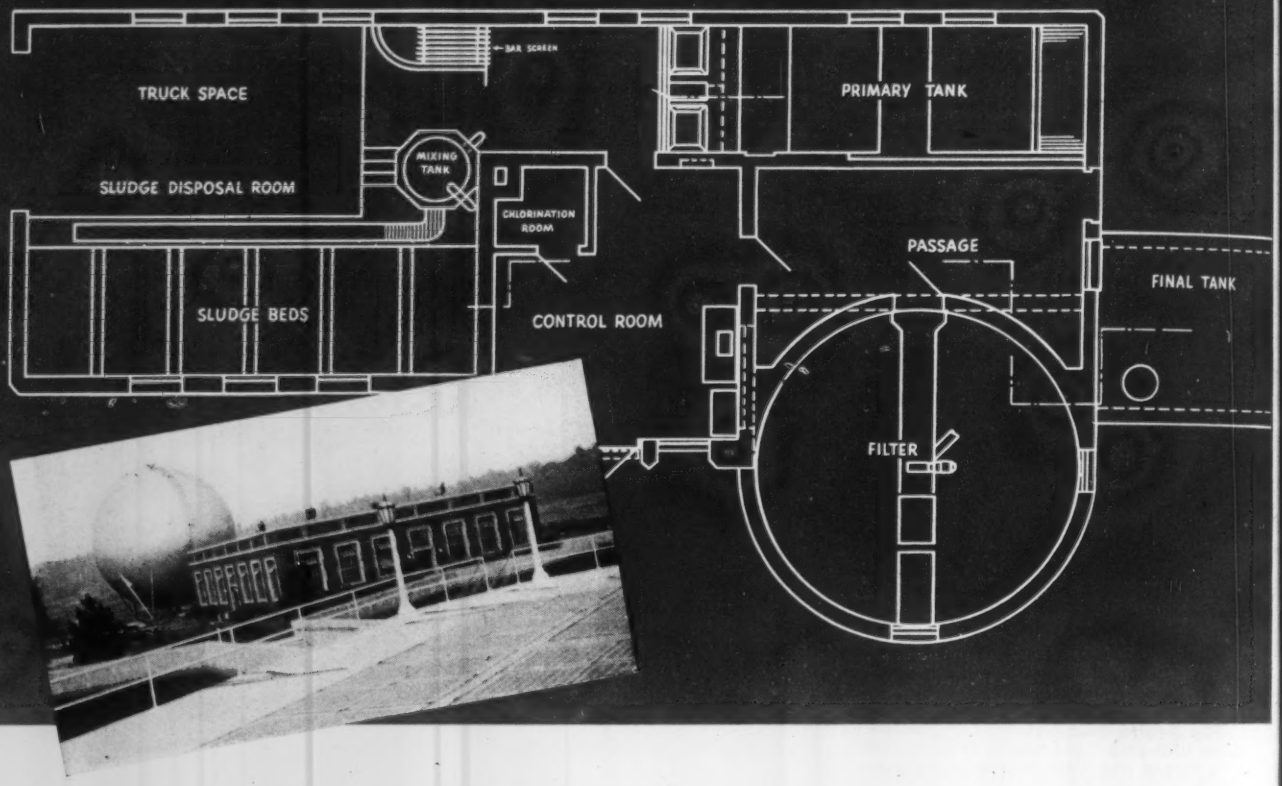

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VOLUME 14 — MAY 1944 — NUMBER 5

South American Trade Centers Linked by Air

By J. STANTON ROBBINS
TRANSPORTATION SECTION, OFFICE OF THE COORDINATOR OF INTER-AMERICAN AFFAIRS, WASHINGTON, D.C.

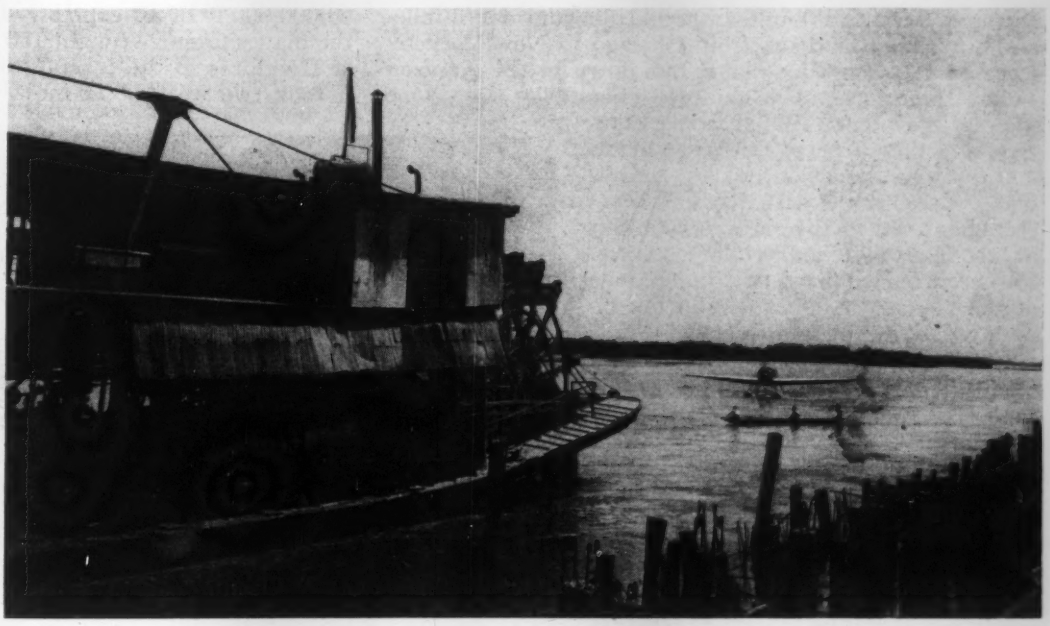
WHILE transportation in North America progressed in slow stages from pack horse to covered wagon, canal boat, railroad, and auto to airplane, the transition in South America from oxcart to airplane is being made in one jump, according to Mr. Robbins. To many inhabitants of rural communities who have never seen trucks or trains, airplanes are quite familiar. Time and convenience as well as cost are reasons given for this phenomenal growth of passenger travel and freight movement by air.

THE American republics are on the threshold of their greatest evolution, the evolution in transportation brought about by the tremendous advances within the last few years in airplane design and construction. Since the republics of America have enjoyed independence, one of their most serious problems has been the lack of adequate transportation and communication between neighboring countries and even between different parts of the same country. The airplane has provided an answer to this problem, for the plane makes short work of mountains and forests, and it crosses deserts, rivers, and pathless jungles with equal facility. The airplane is now breaking down isolation and sectionalism and is giving the peoples of South America a new unity and drawing them into a circle of common interest.

Only five years ago one could travel from Lima, Peru, to Paris in less time and in greater comfort than one could go from Lima to the city of Iquitos, only 745 miles away in a direct line. The hardships of the overland trail between Lima and Iquitos were such that many preferred to get there by ocean steamer, sailing first from Lima to the Panama Canal, then around the northern end of South America, southward to Belem at the mouth of the Amazon and finally 2,300 miles up the Amazon to Iquitos, a trip of some 8,000 miles, requiring at least 30 days. But now that is all changed. Today, planes fly between Lima and Iquitos in a few hours.

In some of the mountain republics, it is not unusual for the cost of inland transportation to double the price of merchandise sent from abroad. Even before the present war, shipping, handling, and insurance charges on a ton of hardware shipped from New York to Bogota, Colombia, were frequently greater than the initial cost of the merchandise. It is easy to say, "Why don't they build railroads?" But anyone who has traveled over the Central Railroad of Peru—or over the 11,000-ft Quindo Pass in Colombia—will have the answer to that. Peru's Central Railway climbs almost straight up, and within the first 85 miles of its length reaches an altitude of nearly 16,000 ft, or three miles above sea level. Peru could never have built this costly railroad were it not for the copper mines at the top, which justified its construction.

South America is more than twice the size of the United States but in each of the republics, with the possible exception of Argentina and Uruguay, nature has imposed serious physical handicaps to travel. Even Argentina,



C.I.A.A. Photo

CENTURIES OF RIVER TRAFFIC IN COLOMBIA ARE REPRESENTED IN THIS MEETING OF A RIVER BOAT, DUGOUT, AND SEAPLANE

C.I.A.A. Photo

HAND LABOR CONSTRUCTING A SECTION OF THE PAN AMERICAN HIGHWAY IN EL SALVADOR

which has a boundary of over 2,000 miles with its neighbor Chile, has no through railroad connection with this neighbor at the present time. In 1934 a long section of the Trans-Andean Railroad was washed out, on the Argentine side of the pass, and has not been rebuilt; a highway is now used to bridge the gap.

This railroad and three rather indifferent highways now cross the Andes connecting Chile with Argentina. These highways cross passes ranging from 10,000 to 12,500 ft above sea level, and are blocked with snow in winter. Only in the extreme southern part of the Andes are the passes lower.

We in the United States, if we wish to travel, have the choice between a 60-mile-an-hour train and a 175-mile-an-hour plane, 18 hours from Chicago to New York by train or 4¾ hours by plane, but down in the Amazon Valley there is no such choice. There they say, "One minute in a plane is equal to one hour on the ground or ten minutes in a plane is equal to a day's journey." And in many cases this is actually an understatement for, in the rainy season, an oxcart does well to make 15 miles a day. Further, the winding, twisting nature of the trails in mountains and forests adds greatly to the total mileage.

The distance between Sucre and Camira in Bolivia, for example, is 300 miles by highway but only 135 miles by plane. This particular trip takes only 45 minutes by plane and anywhere from six to twelve days by road, depending on the weather. Engineers say that it will take five years to build an adequate, 276-mile highway between Cochabamba and Santa Cruz in Bolivia, and the cost will be around $7,000,000. It takes only a few months, however, to level off two or three landing fields.

and the cost is nominal. Planes now mak this trip with local stops in three hours.

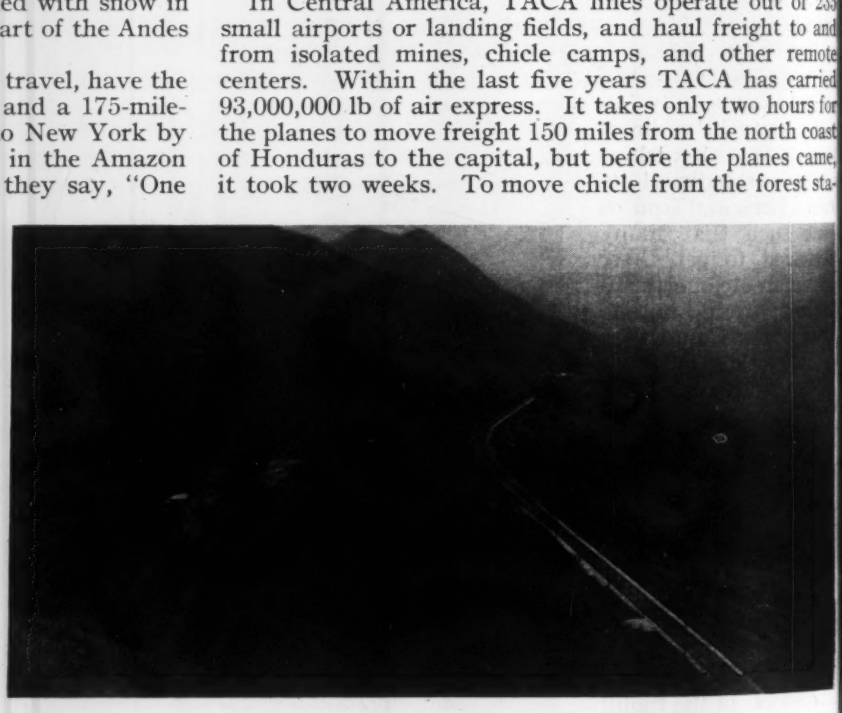
According to Colombian officials, a land ing field with the necessary buildings an installations can be built for the cost of tw miles of ordinary, hard-surfaced highway this is in part due to the heavy grading re quired on these roads. In these lands o vast distances, two miles of highway wi get the traveler nowhere. For this reason a Colombian engineer has said it is better to dot the hinterland of Colombia with 2 or 30 strategically placed landing fields tha it is to try to connect these communities with the capital by road. Roads will be built eventually, of course, but he think landing fields should come first.

AIR FREIGHT ESSENTIAL

Many mining and rubber-gathering enterprises of South and Central America could not operate without planes. The Aramayo Mines in eastern Bolivia, for example, depend on planes for transportation. One can hop from the mine to La Paz in 30 minutes but the trip by trail takes 15 days. These mines, says the manager, could not operate without the planes, as the cost of building an adequate road would be more than the mines are worth.

Traveling through Ecuador from Loja to Cuenca takes five days by trail but only 45 minutes by plane. The distance in an air line is 90 miles and the cost of the plane ticket is less than the mule hire for the overland route. One can fly from Buenos Aires to Tierra del Fuego in about 15 hours, but the same trip by land and water takes several weeks. It is not surprising, therefore, that Latin American air lines carried in 1942 six and one-half times as many tons of cargo as the lines of the United States.

In Central America, TACA lines operate out of 235 small airports or landing fields, and haul freight to and from isolated mines, chicle camps, and other remote centers. Within the last five years TACA has carried 93,000,000 lb of air express. It takes only two hours for the planes to move freight 150 miles from the north coast of Honduras to the capital, but before the planes came, it took two weeks. To move chicle from the forest sta-



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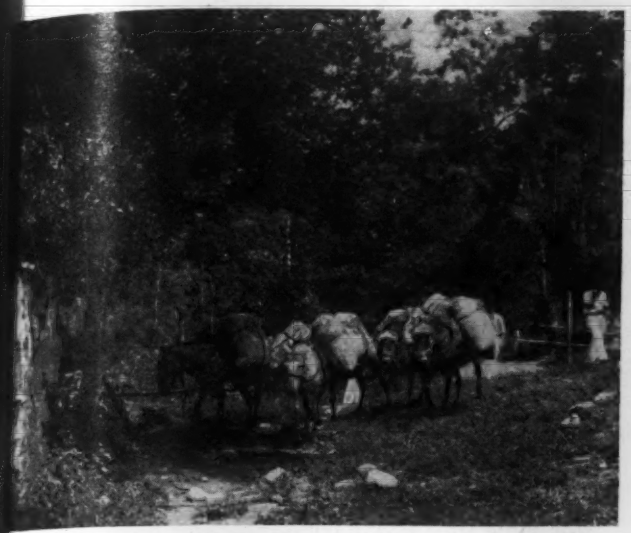
THE TORTUOUS ALINEMENT OF THE SÃO PAULO RAILWAY, BRAZIL, IS TYPICAL OF MANY SOUTH AMERICAN LINES



C.I.A.A. Photo

MULE TRAINS ARE THE ONLY AVAILABLE MEANS OF LAND TRANSPORT IN MANY SECTIONS OF SOUTH AMERICA

C.I.A.A. Photo

LARGE VOLUMES OF FREIGHT ARE NOW CARRIED BY AIRLINES TO AIRPORTS FAR FROM ROAD OR RAIL

tions to Flores, the gathering center, used to take six days using pack mules; it now takes 15 minutes by plane for a direct distance of 50 miles.

Argentine merchants are shipping all sorts of commodities by plane. A recent 2-ton plane cargo sent from Buenos Aires to Quito contained felt hats, leather goods, optical goods, stockings, textiles, pharmaceuticals, seeds, and samples of foodstuffs. The cost of this shipment, it is said, was no greater than ocean freight and wartime insurance, and the goods reached their destination in four days instead of 40.

SPECIAL COMMODITIES HANDLED

Freighting rubber out of the upper Amazon is a third cheaper by air than by the Madeira-Mamora Railroad, said Joao Alberto Lins de Barros, Brazil's Coordinator of Economy. He also says capital at the present time should be invested in air lines rather than in interior railroads. The Tarapato Valley in Peru's Department of San Martin is famous for its fine tobacco but, because of the absence of highways, the tobacco bales have had to be brought to the coast on muleback. This tobacco is now shipped by plane and it is not exposed to the weather.

Argentine ranchers around Salta would like to ship fresh beef by plane to Antofagasta, Chile. The air-line distance between the two is 330 miles. They could profitably do this if planes were available. Live cattle are now driven across the desert and the 12,000-ft Socompa Pass of the Andes to reach Antofagasta.

As the seasons in Argentina are the reverse of those in the United States, seed men in North America now save a full year by harvesting a crop of seed in September, shipping it to the Argentine by plane, where September is spring, plant it and harvest a new crop of seed in February, which is flown back to the United States, reaching here in time for early spring planting.

Hundreds of other trade possibilities exist throughout the American republics and are only awaiting the time when planes, plane fuel, and other equipment become available. Where a large and constant volume of shipping is offered on a two-way movement, and where planes of large capacity specially designed for freight movement are used, it has been variously estimated that air freight could be profitably handled at from 15 to 25 cents a ton-mile. This does not mean that there will be fewer shipments by steamer or by train, or that railroads or highways will cease to be built. There will be more railroads and more highways in South and Central America. The planes will only supplement the ships and the railroads and will never carry more than a fair percentage of the total Inter-American commerce.

But that small tonnage is the leaven of the entire mass—a special machine, a spare part, or a much-needed chemical sent by plane may often keep a whole factory or an entire industry from closing down. Edward Warner, of the U.S. Civil Aeronautics Board, says that the average plane in the Transatlantic ferry service is now carrying 12,000 lb, while 3,000 tons of cargo a week is now crossing the Atlantic by plane at an average cost of 20 cents per ton-mile.

Our modern world is one hundred times smaller than was the world of Christopher Columbus and, on the basis of increased speed of planes, only half as large as it was even in 1938. Today, we are told, no point in the world is more than 60 hours from New York. Small wonder that the Americas are taking to wings!

C.I.A.A. Photo

BAGS OF CINCHONA BARK, COFFEE, AND CEMENT ARE PACKED FOR A LONG RIVER TRIP IN COLOMBIA

Postwar Sanitary Engineering Work for New York City

Engineering and Economic Vision Shown in Paper Presented Before Sanitary Engineering Division at the Society's Annual Meeting

By RICHARD H. GOULD, M. AM. SOC. C.E.

DIRECTOR, DIVISION OF ENGINEERING, DEPARTMENT OF PUBLIC WORKS, NEW YORK, N.Y.

IN New York City a "capital outlay budget" is set up each year to provide for the construction of new works and for the necessary land and engineering costs. The idea of postwar planning for the city apparently took root in the summer of 1941, when consideration was being given to the preparation of the 1942 capital outlay budget. It became evident then that the national defense program would preclude any substantial volume of civilian construction work during 1942. Whereas the 1941 capital budget was in excess of $81,000,000, the city Planning Commission, at the instigation of the Mayor, made provision in the 1942 budget for something over $8,000,000 for the planning of future public works and at the same time substantially reduced the funds available for construction. Later on in the year this budget was modified, further reducing the funds available for construction and increasing the funds for planning by over $13,000,000. By the time the 1944 capital budget was adopted, some $32,500,000 had become available for the planning of postwar projects.

It is thus seen that substantial funds for postwar planning were made available within the normal framework of the city's activities and at expenditures much less than the usual capital outlay figure. This has permitted the continued employment of those of our forces capable of design work and has given a needed boost to the engineering and architectural professions. Above all, by assuring the complete design of a large number of needed works, the city is placed in a most advantageous position as regards postwar construction.

The projects included in the program in every case are to provide only for the normal development of the city, and in most cases have previously been included in schedules for future work. This program includes works for the Department of Marine and Aviation; the Board of Education; the Board of Higher Education; Museums and Institutions; Parks and Parkways; the Board of Transportation; the Department of Water Supply, Gas, and Electricity; the Board of Water Supply; the Borough Presidents (mostly for highways and sewers); and the Department of Public Works and sponsor departments. It is estimated to amount in all to about $990,000,000 of construction. Included in the work to be done by the Department of Public Works is a program of sewage treatment works amounting to $82,000,000. It will be seen that while this latter is a substantial part, it is by no means the largest element in the city's postwar program.

DESIGNED TO MEET SPECIFIC CONDITIONS

For some time now a comprehensive program for sewage treatment has been included in the master plan for the city. This program calls for 17 sewage treatment works, although some of them will progress in stages. Not all are shown in Fig. 1; those mentioned will be referenced by a key number in parenthesis. The total cost of the program as a whole is estimated at about $177,000,000. Of this, six plants with a combined designed capacity of 400 mgd are now operating and treating flows in the neighborhood of 350 mgd. The operating works and their intercepting sewers to date have cost about $58,000,000. When the work now being planned for postwar construction is completed, we will have secured about 80%, in money value, of the entire program, and will have increased the sewage treated from 40% to 85% of the total estimated production.

The comprehensive plan along which we are working is designed to meet the particular conditions of the waterways surrounding the city. It will take into account the economics of construction and operation and make reasonable use of the natural resources of the waterways.

For example, Jamaica Bay (Fig. 1) is a shallow, landlocked body of water having access to the ocean through Rockaway Inlet. It has some 25 sq miles of water area, is dotted with islands, and upon the removal of pollution will be an ideal area for recreation. A number of sources of gross pollution have already been removed by the operation of the extended Coney Island Sewage Treatment Works (7, Fig. 1) and the Jamaica Sewage Treatment Works (11), which was placed in operation on September 28, 1943. The construction of the 26th Ward Sewage Treatment Works (6) of 60-mgd capacity has progressed to a point where we expect to be able to furnish preliminary treatment by sedimentation and sludge digestion by about May 1 of this year. The completion of this plant to furnish treatment under the full activated sludge process is in the postwar program. The only other major source of pollution to Jamaica Bay will be removed by the construction of the 15-mgd Rockaway Plant (13), also included in the program.

The upper East River lies at the meeting point of the tides coming in from the ocean through the Narrows and from Long Island Sound at Throggs Neck. While

OWLS HEAD SEWAGE TREATMENT WORKS—A COMPOSITE AIR VIEW AND ARTIST'S RENDERING

ere are substantial tidal flows roughout this area, there is a rela-vely small interchange with new sea ater. The plants built in this sec-on therefore call for a high degree treatment. The three plants now uilt in this area—that is, Wards land (1), Tallmans Island (10), and owery Bay (12)—all furnish treat-ent by the full activated sludge proc-ss. A similar degree of treatment ill be provided in the new 120-mgd lant at Hunts Point (3) which is in e program. Also included in the rogram, in addition to the intercept-g sewers leading to the Hunts Point lant, are the East Bronx Intercept-g Sewer, which will be tributary to e present Wards Island Plant, and clude areas up to the Hunts Point watershed; and e Whitestone Intercepting Sewer, which will pick up ows from Malba and Whitestone and from the remain-g areas in the Borough of Queens on the south side of e upper East River, and carry them to the present allmans Island Plant (10).

The Owls Head Plant (9), with a capacity of 160 mgd, ill be located in Brooklyn just above the Narrows near 9th Street. Because of its proximity to the ocean and e limited site available, this will be a sedimentation lant preceded by flocculation, with the possibility of rnishing seasonal chemical treatment and chlorination. his plant is unique in that it will be for the most part onstructed on reclaimed land now under water. It will e supported on piles and a fill deposited behind a dike of onsiderable depth.

Also in Brooklyn, the 140-mgd Newtown Creek Plant 5) will serve areas in Brooklyn and Queens now tribu-

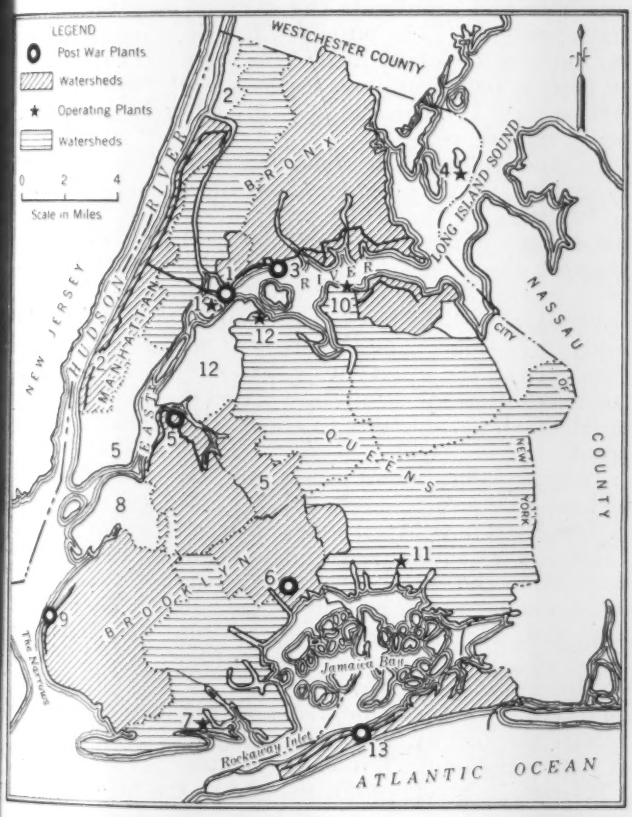
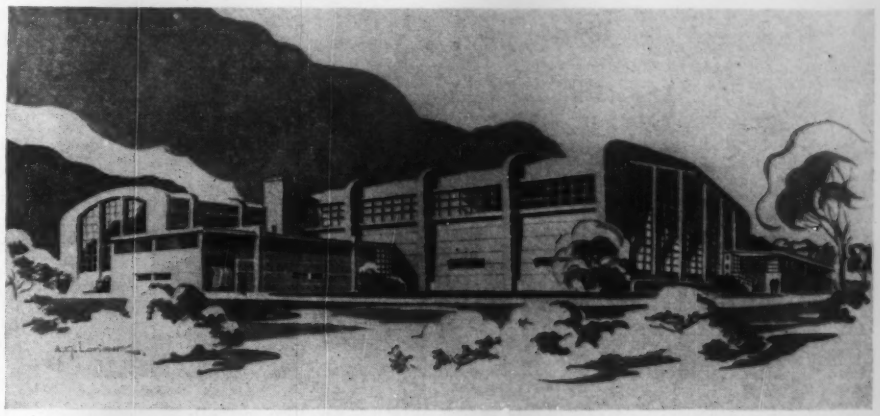


FIG. 1. MAP OF NEW YORK CITY (STATEN ISLAND OMITTED) SHOWING PRESENT AND POSTWAR SEWAGE TREATMENT WORKS



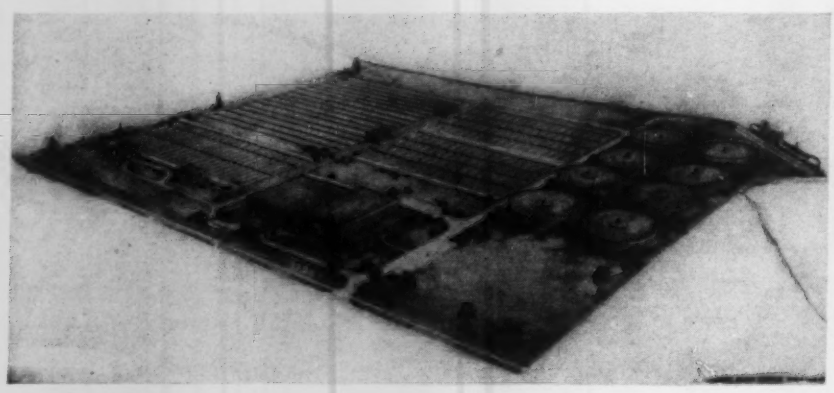
NEWTOWN CREEK WORKS—PROPOSED LAYOU of PUMP AND POWER HOUSE

tary to Newtown Creek and the lower East River. Eventually the plant will be doubled in capacity to serve areas in lower Manhattan. The immediate purpose of this plant is to correct obnoxious conditions that have existed for a long time in Newtown Creek and to reduce the pollution in the lower East River. This plant will provide for sedimentation and will have a long effluent line to the East River. The first stage of the Port Richmond Plant of 10-mgd capacity (not shown in Fig. 1) will permit a more adequate service to areas in the central part of the Borough of Richmond. Later the plant will be enlarged to a capacity of 30 mgd to pick up the remainder of its tributary area along the Narrows.

Largest single project in the program is the addition of 200 mgd of capacity to the existing Wards Island Plant (1) and the building of intercepting sewers and tunnels to collect the sewage now going to the Hudson River along the west side of Manhattan (2) and the Bronx. The crosstown tunnels in this project must be driven probably at a depth of 500 ft to avoid serious geological faults. North and south interceptors along the Hudson River will include a great deal of rock tunnel work as well as some difficult open-cut construction in bad ground. A large grit chamber must be built in Manhattan near the upper end of the deep syphon to Wards Island.

Also included in the program is the completion of certain plants now in operation. These include the vacuum filters for sludge disposal, together with additional chemical handling equipment at the Coney Island Plant (7); landscaping and roads at Bowery Bay (12) and at Jamaica (11); and the provision of additional sludge-vessel capacity to serve all the plants.

A few comments on certain special features to be incorporated in the plants now being designed, together with some of the new developments contemplated, may be of interest. Three plants are being designed for complete treatment by the activated sludge process—the 26th Ward (6), Hunts Point (3), and the Wards Island Extension (1). These will incorporate the most recent versions of the features developed in our other plants during the past few years. At Hunts Point, for example, a three-hour aeration period will be provided together with provisions for "step" feeding at four points in the length of the aeration tank. The final settling tanks will have the point of sludge withdrawal at the opposite end from the sewage influent, and the effluent weirs will be grouped at the influent end of the tank. Sludge will be digested; power will be recovered from the digestion gases; excess sludge will be shipped to sea. Similar provisions will be made at the 26th Ward and Wards Island plants.



NEW HUNTS POINT SEWAGE TREATMENT WORKS, AS VISUALIZED BY ARTIST

The Owls Head (9) design is unique in that particular attention will be paid to the control of odors. The sedimentation tanks will be completely enclosed under a superstructure so that all air and gas from within will be exhausted to a high stack in the pump and power house, with provisions for treating these gases with ozone before discharge to the atmosphere. The digestion tanks are to have fixed covers completely sealed so that no gas can escape except to the gas engines or through a waste gas burner. A cooperative venture with the Department of Parks will furnish playground facilities on the large flat roof of the settling tanks and on the adjacent area, as shown in one of the photographs.

A FUNDAMENTAL ADVANCE, MODIFIED SEWAGE AERATION

Perhaps the most radical departure from usual practice will be in the design of the Rockaway Plant (13). It was originally intended here to provide for sedimentation with seasonal treatment by chemical precipitation, but it has now been decided to take advantage of new principles of "modified sewage aeration" developed from our recent experiments.

Early in 1941 an experimental plant was established on Wards Island, where various phases of short-term aeration were investigated. Certain limitations were established here which have since been tried out in full-scale operation—first, in one of the four batteries of tanks on Wards Island (1); later, in the new Jamaica Sewage Treatment Works (11), placed in operation the latter part of September 1943; and still more recently at the Bowery Bay Plant (12). In brief, the process is similar to the normal activated sludge treatment except that the aeration-tank solids are kept in the low solids range. While the sludge has an active biological life, it is not allowed to develop to the extent of having the normal activated sludge characteristics, with voluminous zoogleal masses and abundant ciliates.

It was found that very substantial purification could be secured intermediate in degree between plain sedimentation and full activated sludge treatment. This was secured with aeration periods as low as two hours and air utilization of from 0.3 to 0.4 cu ft per gal. The resulting excess sludge has the settling characteristics of primary sludge and can be concentrated to from 4% to 8% solids. This treatment can be accomplished in a plant no more expensive than one for chemical precipitation, producing an excess sludge of comparable concentration and bringing about a higher removal of suspended solids and B.O.D. All this can be secured at substantially lowered operating cost inasmuch as chemicals are not required and requirements for power can be largely met by utilizing the digester gases. Results have been so impressive that the principles established are to be incorporated in the Rockaway (13) design.

The first installation of the Port Richmond Plant will provide plain sedimentation and sludge digestion only. The works are being so laid out, however, that when the plant is extended, the principles of "modified sewage aeration" can be adopted.

ENGINEERING ASSISTANCE SOUGHT

Scheduling the work in the postwar design program, and securing a rate of production that will meet this schedule, are difficult. No one can say with any assurance on what day the city will be able to undertake actual construction. We have been directed, however, to proceed on the assumption that construction under the program will start on January 1, 1945. The work has been scheduled accordingly.

The Division of Engineering of the Department of Public Works is not only concerned with this sewage disposal program of about $82,000,000 but also must handle the work for other departments such as Hospitals, Health, Correction, Police, Fire, Libraries, Courts, Markets, and other public buildings. This other work amounts to about $140,000,000. Then we have our own bridge program of about $16,000,000. Obviously a program of this magnitude cannot be handled with existing forces. It has been decided as a matter of policy not to attempt to increase the departmental forces much above the normal complement, but rather to meet the immediate load by employing outside engineers and architects.

This is necessary because there are not enough men on existing civil service lists with specialized qualifications to handle a program as diversified as this. It has been necessary in some cases to spread our forces rather thin to supervise and coordinate the work of outside engineers and architects. The situation has been aggravated by the loss of many of our men to the armed services. Some 49 men in technical classifications have already left us, and we have been unable to secure any substantial number of replacements.

In order to meet our schedules, outside assistance will be required for the program of our Bureau of Architecture on 124 jobs, for the bridge program on five jobs, and for the sewage program on three jobs. Under the sewage program the design of the Hunts Point Sewage Treatment Works (3) has been awarded to Greeley and Hansen of Chicago, and the Rockaway Plant (13) to Metcalf and Eddy of Boston. The Department of Public Works will take care of the intercepting sewers on both these jobs and in addition will do all the work on the five other major projects. This amounts to about 85% of the total program.

Judging from present indications, the sewage program will meet the exacting schedule set down for us. Design is completed now (April 1944) on about 45% of the total value of work in the program, and the rate of progress is such as to indicate completion on time. Great credit for this is due to our present organization. We have not been able to increase salaries to fully meet increased living costs, or to a point commensurate with the value of the work performed. In spite of this, time-saving methods have been adopted and production has been greatly stepped up. There has been, of course, a great deal of complaining, but while the men may not admit it, I believe the good results are due to the fact that they feel they are doing their part to win the peace, in trying to have jobs ready for the boys when they return.

American Inter-Regional Highway System

I. How It Affects Cities

By THOMAS H. MACDONALD, HON. M. AM. SOC. C.E.
COMMISSIONER, PUBLIC ROADS ADMINISTRATION, FEDERAL WORKS AGENCY, WASHINGTON, D.C.

FAR-reaching postwar benefits are expected from the comprehensive master plan of American highway development evolved from joint studies by federal and state authorities. Two papers dealing with the engineering aspects of this plan were delivered before the joint session of the City Planning and Highway Divisions at the Society's Annual Meeting. These two papers strongly support the principles of the Society's Committee on Postwar Planning, at whose suggestion they are given early publicity. In the first of these papers, here presented, Commissioner MacDonald analyzes the planning and traffic problems of cities and shows how the inter-regional plan admirably meets their needs. The second, by Deputy Commissioner Fairbank, will appear shortly.

THE structure that lay hidden in the mind of the architect is disclosed only after a mason has used his trowel and his stone-cutting tools. The same artisan and the same tools may bring into physical existence a loft building without a line of architectural beauty, a suburban cottage open to the sun, with its promise of gracious living, or a world-famous cathedral, ageless save for the savage destruction of war. These buildings in their completed form, varying functionally and architecturally between such extremes, do not invite attention to the tools that were used in the actual building operations. They reflect faithfully the relative abilities of the architects who conceived them while they had as yet only an imagined existence. So with the inter-regional system of highways (Fig. 1). It has potentially beneficial effects on urban areas beyond any tools that have as yet been devised, if the use is designed and directed by superior intelligence. But the same tool may be used to produce disappointing, if not actually bad, results.

Long before the war added its many difficulties, American cities were plagued by traffic congestion, sectional decadence of property values, blight, menacing tax delinquency, inadequate public transport facilities, growing deficits between costs of city government and revenues, high tax rates, and a loss of confidence of investment capital in desirable housing ventures. Today's total of savings and trust funds invested in city property mortgages which could not be liquidated by the total proceeds from the sale of the property itself, is of dimensions sufficient to cause nightmares both for bankers and for those whose savings are thus placed in jeopardy.

There is nothing new in this incomplete inventory of urban problems. They have long been recognized by public officials and by students of urban conditions. In addition to the efforts to improve the long-established routines of city administration, there has gradually come into use, in varying degrees, two additional tools with which to meet certain city problems—those of zoning and city planning. Neither of these is adequate. In fact, it is a serious question if zoning has not contributed materially, as it has been operated, to one of the most serious city problems, that of the blighted areas contiguous to the very heart of the city.

TWIN TOOLS FOR CITY DEVELOPMENT

There are two major reasons why planning bodies have failed to secure strict and adequate adherence to their conception of a city master plan. First, planning bodies, as a rule, have not been made up of the officials of city government who are responsible for the actual construction of the projects involved. This principle of government at any level is capable of a lengthy exposition, but it will surely be accepted that the man whose official position and public reputation are dependent upon his own performance of legally imposed responsibilities, must have an important part in planning the program which governs his use of public funds. This first principle of having officials with legal responsibility and authority points to the second. It carries the implication that a competent technical staff and experienced consultants should be established as a continuing unit of city government. Until city planning becomes a legally established tool for the determination of administrative policies, it cannot be a dependable remedy for certain city ills.

Zoning and planning are only tools for use in shaping and preserving a desirable structure for the city. Both are inadequate for many more reasons than those mentioned. The actual development of the metropolitan sections of the inter-regional highway system, with coordinated expressways, would have an effect not secured by zoning as now practiced or by theoretical planning. The development of the system is a tool of high potential value for securing a more desirable city. In common with all tools, it depends for actual results on the soundness of its conception. The routes must be located in harmony with present needs, and conceived in terms of the city of one or two decades in the future.

CITIES AND THEIR TRAFFIC CREATE PROBLEMS

The proposed inter-regional highway system is based on two interrelated characteristics of cities. One is the pattern of population—the industrial, commercial, residential, and cultural concentration in cities and metropolitan areas. Today, it is estimated that more than 70% of the people in the United States live in urban and suburban areas. Two-thirds live in the 140 larger metropolitan areas delineated by the federal census.

The second basis is the dominant short-trip use of the motor vehicle. Cities and metropolitan areas include both the origin and the destination of much the greater

Dept. of Parks, City of New York
EAST RIVER DRIVE, LOOKING SOUTH TOWARDS BLACKWELLS ISLAND BRIDGE, 59TH STREET
Latest of New York City's Marginal Expressways

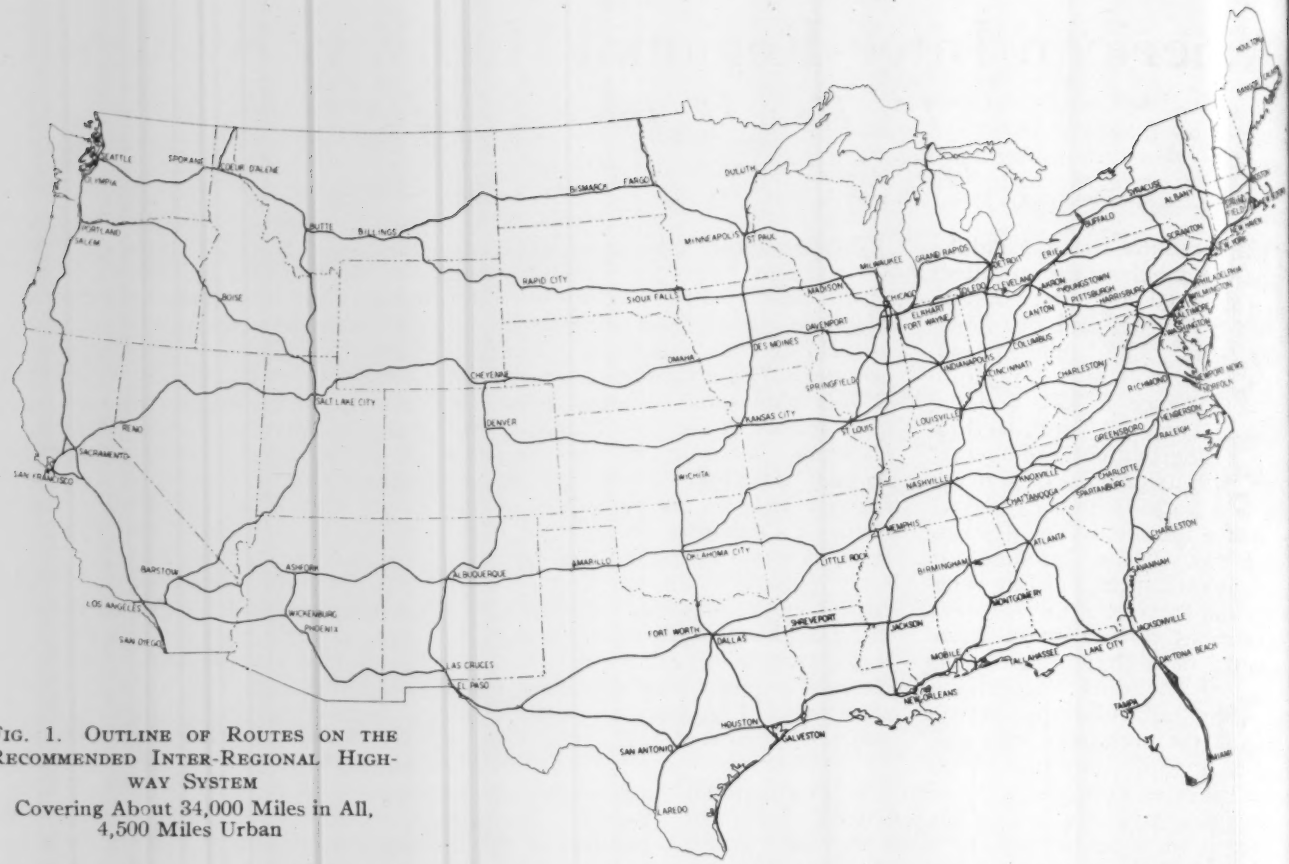


FIG. 1. OUTLINE OF ROUTES ON THE RECOMMENDED INTER-REGIONAL HIGHWAY SYSTEM
Covering About 34,000 Miles in All, 4,500 Miles Urban

part of the heavy traffic that moves over the nation's highways. Of all trips that pass over rural highways for any part of the way, more than 90% are less than thirty miles in length. If to this is added the number of even shorter trips made wholly within urban limits, the preponderant pattern of motor-vehicle use for short trips, broken by long hours of idle parking within metropolitan areas, is vividly defined. The traffic problems this pattern reflects are common to every metropolitan area in the country. In only a few has any real progress been made in providing adequate highway facilities to prevent this problem from becoming more serious.

ADMINISTRATIVE SET-UPS ARE COMPLEX

The inter-regional system of highways and ancillary motorways intended to serve the modern city must be designed to meet the needs of the whole metropolitan area. The U.S. Bureau of the Census defines a metropolitan district not as a political unit but rather as a region that includes all the thickly settled territory in and around a city or group of cities—a composite of the central city and its satellite suburban communities. It is a more or less integrated area with common economic, social, and often administrative, interests.

In each metropolitan area there are large numbers of governmental units, upon which are superimposed additional administrative units, each having legal authority and responsibility within independent or overlapping subareas, and each possessing a greater or less degree of autonomy. There are independent municipalities within the boundaries of some of our largest cities, such as Highland Park in the City of Detroit.

Census data reveal the multiplicity of these governmental units in metropolitan areas. In addition to a very large number of overlapping authorities, in 1940 there were 289 incorporated places in the New York metropolitan district, 118 in the Chicago area, 136 in the Pittsburgh metropolitan district, 93 in the Philadelphia region, and 56 in the Los Angeles area. To these must be added over-layers of townships, counties, towns, sanitary and sewer districts, water and utility districts, even mosquito-abatement districts, and literally hosts of others.

This is the core of an administrative problem that is hopeless in the absence of a legal means of organizing to integrate common interests. The plethora of independent governmental units, each bidding for municipal revenue, legal powers, and administrative prestige, within a metropolitan area that is essentially a social and economic entity, is reflected in high costs for community services, in many inefficiencies in the services provided both by the community itself and by corporations, and in many conditions that definitely detract from the contentment and satisfaction of the average American home.

The storm center of the urban problem is the matter of decentralization—the spreading out of the city beyond its fixed corporate limits. A series of maps prepared for any city, representing the areas of the city and its environs occupied by structures at successive periods of its history, presents a clear conception of the manner of city growth. One of the most striking revelations of such a time series of maps or explosion diagrams, is the manner in which cities have extended outward, beyond their corporate limits, in slender fingers, originally along railroad routes, then following the lines of rapid transit, and more recently, along the main highways entering the city. This expansion is due, in great measure, to the more satisfactory connection between bordering areas and the city proper, made possible by swifter forms of urban and interurban transportation. The result has been the emergence of the metropolitan district instead of individual cities. Chicago, Baltimore, and Washington, D.C., provide good illustrations.

A similar time series of explosion diagrams prepared for the central business area of any large city, reveals the same trend of growth, and for the same reasons. Long before the motor vehicle became a real factor, commercial and industrial uses in central city areas were pushing their tentacles into and through some of the best residential neighborhoods, following lines of transportation.

The failure of zoning as a tool to prevent invasion of residential districts by business is well illustrated by Connecticut Avenue in Washington, D.C. Business concerns now line that major avenue, with only occasional breaks from downtown near the White House to the District line, running completely through one of the most important and desirable residential areas in the city. But, along the whole distance, only the frontage is used. Except near the center of the city, only rarely is the present business use more than a half-block deep.

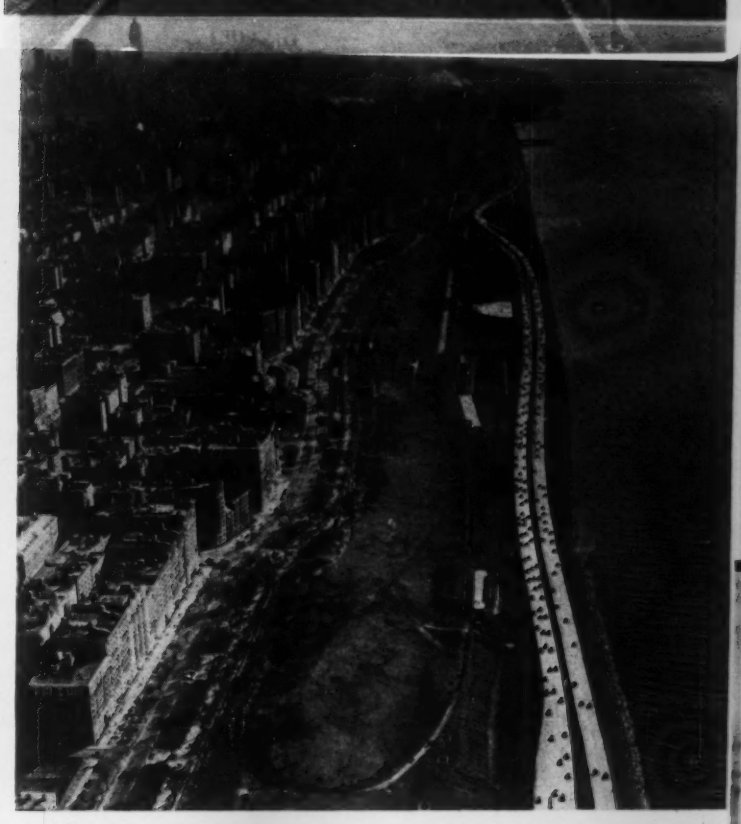
While the motor vehicle and the improvement of some city streets and connecting rural highways in the recent past have been decentralizing influences, there are many other organic centrifugal tendencies inherent in residential and commercial activities—tendencies which manifested themselves long before the era of the automobile. Modern industrial processes, requiring more ground space than is available at permissible cost within the city, have been, and will continue to be, the cause of a preference for outer locations as industrial sites. Suburban home developments have been made attractive at reasonable cost, supplying a type of environment in great contrast to blighted central areas.

Suburban business centers have followed the clustering of suburban homes. And the inadequate provision of parking and street facilities in downtown areas has accelerated the outward movement of some large commercial establishments, as well as branch and chain stores, into suburban communities. Finally, increased centralization of population in urban areas, and the modern tempo and dimensions of business and industry, complete the list of dynamic forces that have made decentralization of the original city inevitable.

These decentralizing tendencies, universally associated with the modern city, have left in their wake blight,

PARKING GARAGES SAVE STREET ROOM—OPEN-WALL TYPE

decadence, and higher costs for poorer municipal services. At the same time, they are warping the whole city structure. The dispersive tendencies of most centrifugal movements, when not controlled, result in waste of public facilities and of urban land. Sporadic urban expansion, left largely in the hands of the subdivider, creates ribbon developments along transportation corridors, and leaves large undeveloped interstices between



HENRY HUDSON PARKWAY, NEW YORK, LOOKING SOUTH ALONG RIVERSIDE PARK
Example of Urban Express Highway Built Partly Over Railroad Tracks

them, greatly increasing the cost and difficulties of providing essential public facilities and services.

While recognizing that decentralizing tendencies are inherent in modern processes of commerce and industry, and in the several transportation media, there are few if any students of city structure who can see any economic or social reasons that justify robbing the historic business center of much of its importance as the location for a large part of the city's daily activity. Within the foreseeable future, this area is likely to remain the objective and source of a large part of the daily street and highway traffic. The existing business center can be preserved and assured if it is, or becomes, truly the city center—if municipal and cultural activities are grouped in functional and artistic fashion; and if its business and commerce are of such a character and quality that they can be supplied only in that city center. To survive, the city center must become economically, socially, and functionally the heart of the area.

WHERE THE MASTER HIGHWAY PLAN FITS

In this setting, the proposed inter-regional highway system looms as perhaps the most plausible solution to the transportation deficiencies of the modern urban area. If the cities so determine, the inter-regional highway system can provide an unparalleled opportunity for rebuilding along functional lines, following rational master plans.

If the city structure is to be remodeled in an orderly manner over a period of years, it is urgent that the undertaking be begun by the establishment of a metropolitan master plan. Such a community plan will serve to indicate the general lines to be followed for the functional replanning of the city and its metropolitan region. If the plan is put into effect, values in decadent areas will be progressively restored and those in the central business district will be preserved because all urban land will be converted to its best use. It will serve to check destructive and uneconomic decentralization and to control linear expansion.

EXAMPLE OF DEPRESSED CONSTRUCTION THROUGH CITIES
This Stretch Suffers from Cramping by Inadequate Right of Way

In terms of transportation needs, a functional metropolitan plan will provide for both local and through traffic, on express highways separate and apart from land-service streets. Until the era of the motor vehicle, practically all our highways and streets were utilized largely for access to farms and homes, factories and business establishments, and recreation facilities. They were the land-service roads in city and country alike. Today, because of new needs and new conditions of travel, we have learned that some highways and streets must be designed and constructed as through routes to provide for the same movement of large numbers of vehicles with minimum interference and loss of time.

Careful inventories of our highway plant, and thorough analyses of the use to which it has been put in recent years, reveal that we lack adequate facilities for uninterrupted traffic in areas of high traffic density, and in cities. The proposed inter-regional highway system will make initial provision for facilities expressly designed for arterial use in urban areas, with plans for the addition of other similar arteries, appropriately located in relation to neighborhoods. At the same time, it will provide the occasion for the remodeling of the city—now a more or less amorphous mass—and for converting it into an orderly arrangement of neighborhood cells connected by the arteries.

IMPORTANCE OF CITY PLANNING AND LEGISLATION

Provision must be made for terminal and parking facilities as an integral element of the major highway and street plan. This is in keeping with the recent recognition of the fact that an overall service from origin to destination is necessary for the full realization of the speed, economy, and convenience that efficient highways and streets should provide.

Of necessity, such a metropolitan plan must be implemented by adequate legislative and administrative techniques. Every city and metropolitan region must have its own planning body made up of the appropriate officials of the governments and interests in the area. Such a planning group must be legally committed to evolve and support the metropolitan plan. In addition, whatever devices and funds are necessary to facilitate the assembly of the necessary lands must be supplied. Particularly, cities and metropolitan authorities should be given the right to acquire land for public purposes, after certain preliminaries designed to protect property owners have been complied with. With respect to transportation facilities particularly, legal authority for the establishment of limited-access highways—parkways and freeways—should be lodged with the states, the cities, and other local units.

If the inter-regional highway system is to be truly effective in achieving the ends for which it is designed, it must be conceived only after a careful and complete functional study of the city organism. It may then be possible to devise a rational plan of future land use that will assign more or less specific areas to each of the principal classes of use—residential, cultural, business, industrial, etc. Having planned such rational distribution of land use, it may be possible to obtain the public consent necessary to the establishment of legal controls and the machinery that will assure actual development over a period of years in conformity with the plan. In this case, city streets, inter-regional routes, and all other urban facilities would take the forms and locations necessary to serve the intended land uses. Also, these facilities would be provided at the proper time to ensure the development of the entire plan, and in such manner as to bring about its undistorted realization.

But whether or not there is acceptance of a rational course and control of development, the provision of inter-regional routes will exert a powerful influence in shaping the future development of the city. This beneficial force should be so applied as to promote a desirable development or, at least, to be consistent with a natural development. If it is so applied, the new inter-regional facilities will speed the development and will grow in usefulness with the passage of time. An unwise location of the facilities may not be sufficiently powerful wholly to prevent a natural or logical future development of the city, but it will at least retard that development and possibly distort it unreasonably. And if the location is unwise, the facilities created, which as a matter of course should be designed for long life, will finally remain as encumbrances to the city's functions and as all-too-durable reminders of the absence of good planning.

NATIONAL HIGHWAY PLAN BENEFITS CITIES

The national system of inter-regional highways proposed, within the limit of the mileage adopted, connects the larger cities and metropolitan areas, directly joining region with region and major city with major city. For this reason, although in miles it represents only 1% of the entire highway and street system, it will probably accommodate not less than 20% of the total street and highway traffic. Intensive study has revealed that any other system, either materially larger or smaller than that proposed, would have a lesser average utilization.

Thorough study of the problem indicates that the sections of the recommended system within, and in the environs of, the larger cities and metropolitan areas are the most important in traffic service and yet the least adequate in their present state of improvement. These routes include those around, as well as those into and through, the urban areas. If priority of improvement within the system is determined either by the benefits resulting or by the urgency of need, it is to these sections that attention will first be directed.

Our cities are worth preserving. The gradual remodeling of their existing amorphous structure into neighborhood cells is both logical and natural. The city will always form the vital nucleus serving the essential needs of the metropolitan region. Because the arrangement of highways and streets exerts such a profound influence on urban life, the proposed inter-regional highway system may well constitute the key to the functional rebuilding of our cities. But the cities themselves must recognize that while opportunity is at hand, they must exploit it to the fullest if they are to survive.

Reminiscences of a Field Engineer

Who Has Followed His Profession from Tropical Swamps to Western Mountain Tops

By Shirley C. Hulse, M. Am. Soc. C.E.

Vice-President, The Hartley National Bank of Bedford, Bedford, Pa.

EVENTS in many an engineer's life are worth hearing about, especially if he, like Mr. Hulse, has the knack of recounting them. These incidents extend from New York State to Central America and then to the Far West; they present effete Easterners, rough mountaineers, and tropical bandits—which gives some idea of their scope, not to mention their vivacity. Mr. Hulse's anecdotes were submitted to the Pittsburgh Local Section some time ago when he was awarded life membership in the Society. The photographs are from his extensive records; but for space limitations, many more could have been used.

ANYONE connected with the Society for a great length of time is apt to forget how and why the association started. As I write this, I have before me my record of membership. It is a condensed reminder of most of the fun I have had since I got out of school. And may I say right here, that for sheer sport I know of nothing that compares with a cofferdam on a bad bottom. For instance, when we pumped out the one at Hog Island, no one knew if it would cave in or not. I sat all day long on a pile head with a .45 Colt in my hand and every man in the hole had orders to go for the bank if the gun cracked, and not even to bother trying to save his tools. But that is getting somewhat ahead of my story.

The Society never had a better booster than Gardner S. Williams, professor of hydraulics at Ann Arbor, later at Cornell. Every boy who came in contact with him was impressed with the idea that he should join as a Junior as soon as possible, and rise in rank thereafter as best he might.

My own Society emblem has been perhaps my dearest possession. The first I owned got dropped on the street in New York, where a horse stepped on it—a misfortune that might happen again if the tire shortage continues. The second, at about the time I was writing for a new one, came back in the pocket of a packer who had picked it up in the trail, miles above my camp in the Cascades. I forget how that second pin finally got away from me, but the lucky third, which I now have, might last me through. Speaking of the Society badge, Dr. George A. Soper, discoverer of "Typhoid Mary," liked to tell how one of his little boys asked, "Daddy, why do you always wear that little blue pin where everybody can see it?"

My first work, following graduation from Cornell in 1902, was on water works improvements for Ithaca, N.Y., under Professor Williams. For this work he designed his famous "Eggshell" Dam, an arch span about 100 ft high, with a maximum thickness of 7 ft 9 in. So far as I know, no one ever kicked any hole in this design, but because of protest from the citizens of Ithaca, the height of the dam was very much reduced by way of the arbitrary power of the State Board of Health. One taxpayer asserted in public meeting that he was attaching a rudder to his house so that he could sail right on down Cayuga Lake when the dam broke.

Before leaving that vicinity, I did some work on the Ithaca typhoid epidemic. In this connection my personal high spot was the evening I learned that a tap I drank from regularly in the Ithaca Hotel supplied raw water instead of sterilized as I had thought. Anyhow, it didn't take.

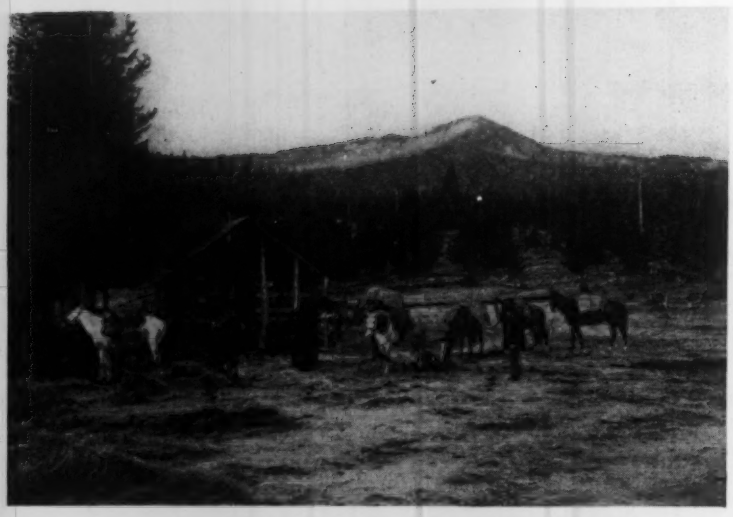
In 1905 I went to Cuba, as instrumentman on a sugar plantation development. Cuba, in a way, was a disappointment. I was told that they had a grand big potential waterpower layout and that it could be my baby, but all I did was run lines through the jungle behind twenty or thirty brushcutters, laying out cane fields. Of course, any first visit to even the near-tropics is bound to be interesting. There were days when it was almost impossible to make the natives work because of the mosquitoes and sand flies, and if you forgot your daily five grains of quinine you were sure to be sorry.

I saw my waterfall only once, and then in company with a chap who always insisted on packing a gun—to the discomfort of anyone he chanced to be working with. We had left our horses and were making slow going when we ran into a bunch of wild hogs. My friend went for his gun, and quite by accident, hit one. Luckily, the log we scrambled onto was so big that the hogs couldn't reach us, but they kept us up there three or four hours. This experience stood me in good stead years later, in Central America.

One camp was on the Nipe Bay and there was a 60-ft pile-driver near the water's edge. Usually on the bay we had a pure white sunrise without a trace or even a suggestion of color. Against this background, flocks of flamingoes straggled across from their roosts to their feeding grounds, gorgeously red in the dazzling morning light. I never missed this show, from the top of the pile-driver, when I was in that camp.

Four of us—an old Chilean named Poppe who had survived most of the big engineering jobs in South America, and Heaven knows how many revolutions; a typical Englishman, if there is such a thing, who had once stroked an Oxford crew; a Yankee railroad engineer whose experiences anyone might envy; and I—had a nightly poker game that ran for perhaps three or four

Railroad Bridge near Santa Rosalia, Chihuahua, Wrecked by Villas's Forces



OREGON—PACK TRIP TO OLLALIE BUTTE

Typical of the Meadows in the Upper Country, Where the Streams Have Their Headwaters

months. But, by the grace of the law of averages, I owed the game only 37 cents when I had to quit and come home. And on the way, I spent a night with the one and only Lee Christmas, who showed me Havana.

At Scotland, Conn., in 1908 there was a 40-ft power dam to be built. This job never fell below concert pitch. First off, the insurance people wanted me fired because I had prevented a hurt man from bleeding to death instead of keeping away from him till their representative arrived. I had my first showdown with the Italian Mafia—and it wasn't nice.

The concrete "flashed" in the buckets and had to be dug out to drop in the forms. The chief chemist of the cement company was fired, and a well-known cement authority of the day said the trouble probably had to do with the size and shape of the grain in the sand we were using. We tried several different sorts of sand, with the same result. It took the stuff a month to set, and the form schedule went "haywire." Years afterward, a chemist who had worked in the Willimantic thread mills upstream from the job told me that there was a trace of an obscure chemical in the mill wastes—so little it could hardly be picked up in analysis. It was this that had slowed the setting of the cement, although it did not affect its final strength.

One stretch of ten days, when we were short of help and working the full 24 hours, I never left the job, changed my clothes, or washed; and whenever I crawled behind something and lay down for a nap, someone promptly rooted me out and said, "Come on over here and see about so and so." No one would believe that anyone could be as dirty as I was by the third or fourth day.

Then followed an assignment as field engineer in the Far West. This Oregon job was perfect—two solid years of it. They gave me a foreman who could run the work all by himself, and told me to spend all the time I could up country, looking for potential water power and anything else interesting. The Clackamas River drops 40 ft to the mile and is full of big trap-rock fragments that never lose their corners and edges. In there, a saw log simply doesn't last long enough to pay for the work of putting it in the stream. There was nothing above the job that could be called a road, and there were few trails a horse could negotiate. The timber was virgin and the whole country magnificent beyond description.

An Austrian mountaineer named Anton had homesteaded there twenty years before. Together we prowled over a lot of territory. One spring we decided to tackle, on snowshoes, a trip that was practically impossible in summer because of the dense vegetation. I weighed about 150 at the start of this hike of maybe 120 miles, and when we got back, after a long, long bath and all I could eat, I tipped the scales at 120. The last night out, as we crawled into the hay under a shed someone had built on the edge of a beaver meadow, Anton said, "Mr. Hulse, I wouldn't do nothing like this last week for no three dollar a day—but don't it beat hell the things a feller does, just for fun!"

AGAIN THE TROPICS CALL

Beginning in 1912, I spent considerable time south of the United States, first in Chihuahua Province, Mexico, on a hydroelectric development. Our project, La Boquilla, was an outstandingly big job in all its dimensions. Little by little, I accumulated interests and responsibilities, and after my superior, the late William B. Fuller, M. Am. Soc. C.E., returned to the States, the job was all mine until we had to shut down because it was quite impossible to get anything more in the way of supplies. There was a Mexican village of something like six or eight thousand population and a native guard with a succession of captains who sometimes got themselves killed. Part of my job was to keep this guard supplied with enough ammunition—so it could "function."

My own particular piece of personal help was a man who had come to Mexico years before to handle a couple of unbreakable horses—too valuable for breeding purposes to be destroyed. At the age of twelve, he had played deputy to his father, sheriff of a county that adjoined Pat Garrett's, when Billy the Kid was in his heyday. If my friend Perkins didn't know all the answers, I never found it out. The proudest moment of my life was when he told me that if I had been born with bigger hands and in the right place, I might have learned to "shoot a six-gun and ride a horse."

We were in the middle of the Revolution, and there were a couple of pitched battles right on the job. Luis

REVOLUTION MIXED WITH ENGINEERING

Some of Herrera's Mexican Soldiers Cut Up a Steer—on the Job

Herrera kept me most of one afternoon looking cross-eyed at a firing squad because he couldn't open the safe and the cashier was too drunk to work the combination. Ultimately, I realized that our $30,000 weekly payroll was all the money coming into northern Mexico; that no matter how bad things might look, that flow of cash would not be interrupted if the Revolution could prevent. And anyhow, those in control had means of getting most of the money after the help had been paid.

Once, when we were strapped for cash, I went down to Torreon on the train to get $150,000 that somehow had been put where we could reach it. The problem of course was to get it to the job. It was an all-day ride on the train and nothing in the appearance of the passengers, going or coming, inspired confidence. I had an old Oregon packbag with me and I spent a morning in Torreon's biggest store, ostentatiously buying stuff of the sort anyone would buy if he had a Mexican girl to

A ROYAL EQUIPAGE—VILLA'S FOUR-MULE COACH
Also an American Auto Not in Running Order; It Had to Be Hauled Out—as the Mexicans Said, "Auto-Mulo"

buy it for. By noon, the whole town knew all about it. That night, the money took the place of the finery in the packbag, and the next morning I climbed on the head end of the front passenger car and stood in the aisle till all the passengers had seen me—and grinned at the packbag. Then I dropped the bag, kicked it under the seat and went visiting with friends, old and new. The bag was there, intact, when I returned—or I'd probably not be writing this now.

General Villa—everyone has seen Wallace Berry's version—once sent me word that I could have three carloads of "merchandise" (loot) for 10,000 pesos. Juan Dozal, his chief of staff, sat in my office on a box containing 3,000 rounds of Mauser ammunition, gathered for our guard, while he told me about this. Juan was a "good egg," and right then Villa needed ammunition a lot more than he needed money. And I was always sorry I never got to tell Juan about those shells. It was impossible to take up the General's offer, as he made it, but we arranged to have his stuff land on the job just after the help had been paid, so the General got nearly thirty thousand instead of ten, and the camp sorely needed supplies, mostly food and clothing.

COMPLICATIONS FAR FROM ENGINEERING

Next day, Juan was back with another proposition from the General. It seemed that Villa needed an honest man to take care of his money—when he had any. Further, it was costing him around a thousand dollars to do a million dollars' worth of damage—to railroads, bridges, and the like. His recent transactions with me led him to think I could be trusted with his money, and my engineering ability should enable him to do a million dollars in damage for not more than five hundred dollars in cost. Further, I could name my salary, and do as I pleased. I asked what the latter prerequisite might imply, and Juan said it covered anything and everything but the girl the General might be interested in at the moment.

This "royal command" was the toughest spot I ever talked myself out of. But the General remained my friend and when he borrowed our only running automobile as we were leaving for the border, he loaned us his own private stagecoach with its driver and four magnificent mules—a bit of property whose like I have never seen in any movie, and in itself a safe-conduct anywhere in Chihuahua.

The first time General Villa came on the job, I had occasion to ask him to sign some papers, and at the same time I offered him a cigarette. He had previously declined to drink anything but "a big pitcher of cold water." As he put his hieroglyphics on the papers he remarked that he never had had time to learn to smoke, or to write his name, till they put him in jail down in Mexico City, but he was learning new letters right along and, if he lived, hoped some day to both read and write. I made some inane reply to the effect that it might be worth going to jail for the sake of a few cigarettes and some education, and the General asked with characteristic gravity, "Have you ever been in jail?"

I tried again. The guard used to get drunk occasionally and sit all night long outside our fence, singing the endless verses of *La Cucarracha*, dealing with the life and adventures of *el valiente Pancho Villa*. I told the General that, considering all he had done in the song, I had expected to meet an old, old man with a long gray beard. The General replied gravely that, as near as he knew, he was 36 years old.

Only once have I seen Villa laugh—when someone told him that Luis Herrera had suggested shooting Mr. Fuller and me and putting us both in the same grave—with me on top where I would "sleep soft." Mr. Fuller's figure, I should add, was more than generous. At this, Villa threw back his head and roared. Nice sense of humor!

HUNTER OR HUNTED

Nicaragua, scene of my next assignment, is especially interesting in the matter of its amphibious natives. A man who had been almost everywhere once told me that the coast Indians—a mixture of Carib and Negro—are the best canoe men in the whole world. Away in the interior are a few hundred Sumus, said to be the tag end and remnant of whatever race first came across from Asia by way of the Aleutian Peninsula. I never met anyone who could speak their language, apparently consisting of but a few hundred words, going strong on inflection and context. They are all tuberculous—but the disease never kills them. I once stumbled on a couple of villages about licked with measles and chicken-

NICARAGUA—UP THE WANKS RIVER BY DUGOUT

AN INDIAN FESTIVAL IN MEXICO, COMPARABLE TO THANKSGIVING During the Three Days of Excitement, Photographers Were Not Popular. While Kneeling and Aiming Camera at Wildly Gyrating Apaches, Mr. Hulse Was Knocked Unconscious by a Swinging Machete, Luckily by the Flat of the Blade

pox, and even worse, clear out of salt. Their beadwork is very beautiful and in some patterns almost impossible to secure. I had plenty of salt in the canoe, and they insisted upon overpaying me with their choicest beadwork; for the salt.

On my first trip, I took a 20-gage pump gun. This was all wrong in the bush, where there is an infinite variety of game, and if you have the wrong load in the chamber, and work the action to change it, your intended victim is startled by the noise and one quick move takes him out of sight.

My profit from the Cuban wild-pig party came the day I hunted a trail with Lorenzo, the canoe captain, while the boat was being repaired. Along the way we came upon the wreck of a big jaguar, slashed and trampled into the mud, and Lorenzo muttered, "*javali.*" Further on, he pointed to where the pigs had crossed the trail into a dense thicket of bamboo, difficult to penetrate and impossible to move quickly in. Lorenzo got excited.

"Come, the pigs are close by—hurry, hurry!"

"But Lorenzo, how can we climb that bamboo?"

"But Jefe, what need to climb? We will meet the pigs and you will shoot all of them!"

At last, I comprehended. "Lorenzo," I said, "You understand that this gun only shoots five times?"

"*Vamonos!*" he yelled, and started full speed for the river.

Once, to catch a steamer at Bluefields, I had to run down the coast a hundred miles over night, in an open 20-ft native boat. It was a glorious night but the wind seemed to me very strong, and after the crew got the sail up and stopped me from smoking because the gas tank leaked, I asked how far we would be offshore.

"Oh, maybe ten or twelve miles."

"Suppose anything happens—I can't swim that far."

"The board you sit on is loose—hang onto it and we will take care of you."

"How about sharks?"

"But Captain, we can't promise everything!"

There are undoubtedly times when the inate courtesy of the native is sorely strained by the helplessness of the white man, for whose comfort and safety the native is responsible. But in my experience the courtesy is unfailing—always.

Back again in the States, I had several jobs in th wilds. Colorado in the summertime I found to glorious, with its profusion of lovely wild flowers. O day I had a hard climb to make with Oscar, a big Swed As we scrambled on to a summit of around 14,000 f Oscar paused by some forget-me-nots growing out of crevice and said, "Mr. Hulse, when it comes to di tributing seeds, God has got Congress beat all to hel ain't he?"

In Tennessee, on the construction of Alcoa Dam, spent my spare time with Andy Orr, the only man ever knew good enough with a turkey wing bone to c a bobcat into range and kill him. I saw this happen. saw him kill more than one turkey, on the wing, with h rifle, but oddly enough he was just ordinary with h revolver.

He produced a brand of "white mule" that I simpl couldn't handle—one teaspoonful gave me a splittin headache. A gang of Maine loggers doing the cofferda on the job, drank it out of tin cups and then went wil The stuff was kept in fruit jars under the cabin floor an whenever the baby started fussing, Andy's wife dippe a corner of her apron in the moonshine and gave it to th baby to suck.

Andy's troubles with the authorities finally started hi for Oklahoma, on foot with his rifle, but they picked hi up at the county line and put him in the "pen," where h died after a few months. As one of his neighbors com mented, "Andy war the sort that gives a community a bad name."

SHIPS AND OTHER PROBLEMS

Present activities in our shipyards remind me of Ho Island in 1918. I suppose nothing was ever quite like it Ira W. McConnell, M. Am. Soc. C.E., was in charge fo a while, and then the place was not so much like a mad house. I had known Mac when he taught Freshma mathematics at Cornell.

Never will I forget the launching ceremonies of th second ship—ours. Especially Butch McDevitts's clos ing plea has stuck in my memory: "Boys, I'm going Over There. Maybe some of you will go too, and some day, in No Man's Land, if you fall in a shell hole and see a hand sticking up out of the dirt, shake it. It might be mine."

After the war, I was superintendent on an intake tunnel job in quicksand at New Orleans. Just around the corner from our job the Marx Brothers ran a junk business that dealt in everything from tin cans to battle ships, and never failed to supply us with anything from ideas to equipment.

One night when we were opening the levee section— where you might uncover anything from the skeleton o a hoop skirt to a telegraph pole, the gang was brought up short on an old concrete roadway. My blasting permit, most grudgingly granted by the U.S. Engineer Office, specified that any shooting had to be done by me per sonally. I sent for some drills and powder, but none came. Meanwhile all the native help, black and white, gathered round the hole and looked down at me—very solemnly. A big negro spoke up: "Boss, if you says so, us will take that concrete out with our hands, or bite it out with our teeth—but you just kaint shoot in our levee."

Often it occurs to me, how many big engineering struc tures do we remember whose sheer beauty first impressed us rather than their always obvious usefulness? I can vouch for two—the Bear Mountain Bridge while its main cables still flaunted their priming coat of red, and the big Coolidge Dam from way downstream. It may be rarely, but sometimes it has been done.

High-Level Highway Bridge Spans Thames River

III. Sheet-Steel Cofferdams Used to Unwater Footings 60 Ft Below Water Level

By H. Alden Foster, M. Am. Soc. C.E.
Designing Engineer, Parsons, Brinckerhoff, Hogan and Macdonald, New York, N.Y.

TO support the central spans of the Groton–New London Bridge, piers were founded on steel H-piles driven to rock. The cofferdams chosen by the contractor to unwater the footings were of sheet-steel piling with both steel and timber bracing. This bracing was prefabricated before it was placed within the driven sheeting. The development and design of this structure were described by L. G. Sumner in two previous articles, in the March and April issues.

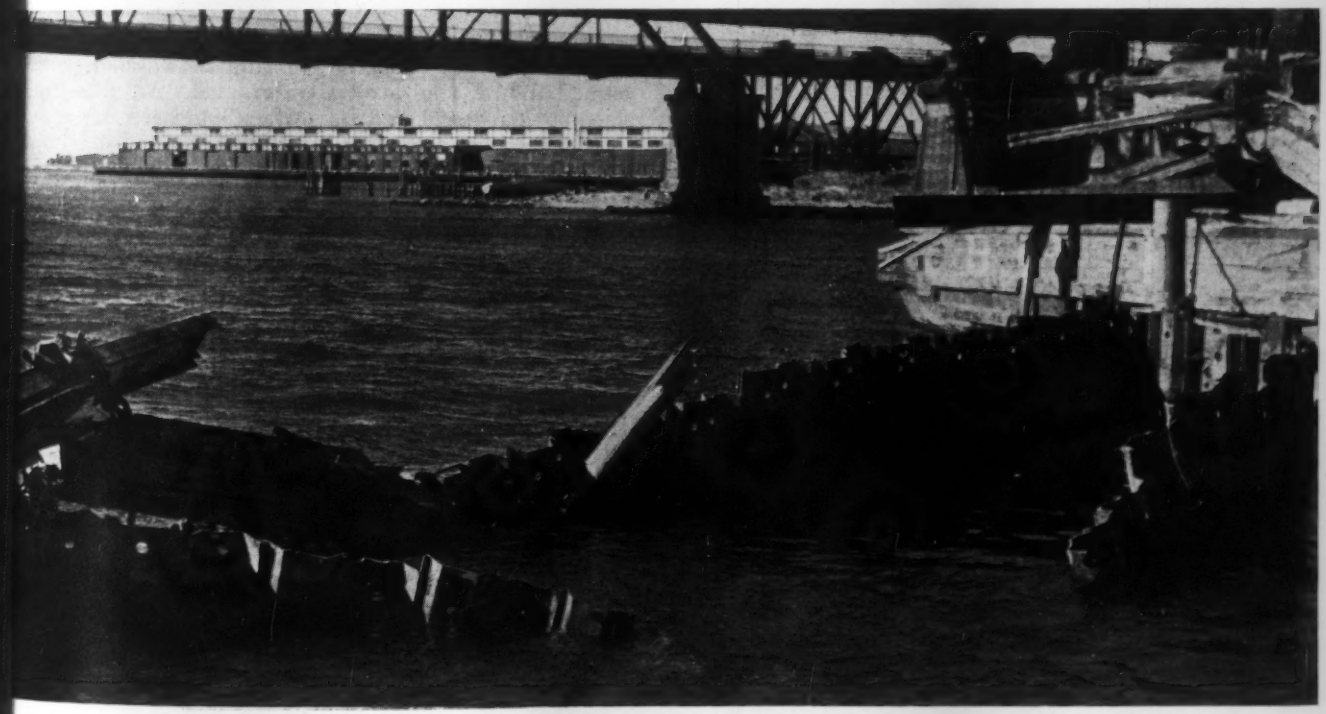
PIERS of the Groton–New London Bridge, crossing the Thames River at New London, onn., are in general of simple de- gn, each consisting of two rein- rced-concrete shafts connected at p and bottom by heavy bracing eams or ties. The shafts are step- pered on three sides to give a more aceful effect. On the land piers, e bottom ties extend above ground vel, but on the river piers these es are at or below the water level. Piers supporting the continuous-girder approach spans, gether with the abutments, are founded on spread otings resting on firm sand or gravel. As the footings f the land piers were only carried to relatively shallow epths in the ground, their construction did not involve y particular difficulties. The footings of the river iers, however, were extended to depths varying up to 0 ft below mean low water. These piers rest on steel H- les driven to rock at depths as great as 160 ft. Their onstruction involved a variety of interesting problems.

ORIGINAL DESIGN FOR RIVER PIERS

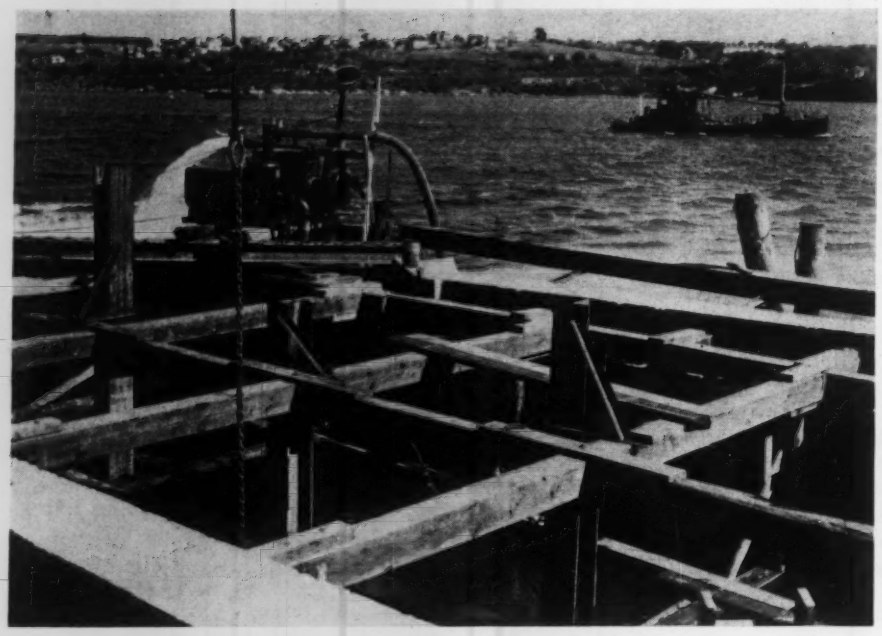
The typical design of the river piers is given in Fig. 1, hich shows the original design for Pier 26, the westerly ier of the main river span. This design required the construction of a steel sheet-pile cofferdam driven to El. −80 ft, or about 40 ft below river bottom. The river bed consists of organic silt to about El. −90, below which point sand and boulders extend to rock at about El. −130. The cofferdam was to be excavated to El. −60. The H-piles would then be driven to rock and if necessary cut off under water at El. −48, or 12 ft above the bottom of the excavation. The design provided for placing a concrete seal by tremie to a depth of 21 ft, after which the cofferdam would be pumped out, and the footing slab, distributing beam, and pier shafts placed in the dry.

Driving of sheet piling and the excavation for Pier 26, the first river pier undertaken, were carried out in conformity with the original design. After the area within the cofferdam was dredged, the H-piles were driven but not cut off, and the tremie concrete seal was placed. A number of the bearing piles were left with their tops projecting above the tremie slab.

While being unwatered, the cofferdam for Pier 26 failed, when the bracing completely collapsed. Before the dam could fill with water, the sheet piling was deflected inward on all sides. Because of wartime conditions, it was impossible to obtain additional sheet-piling



Cofferdam for Pier 26 After Collapse



BRACING IN PLACE AFTER REPAIR OF COFFERDAM

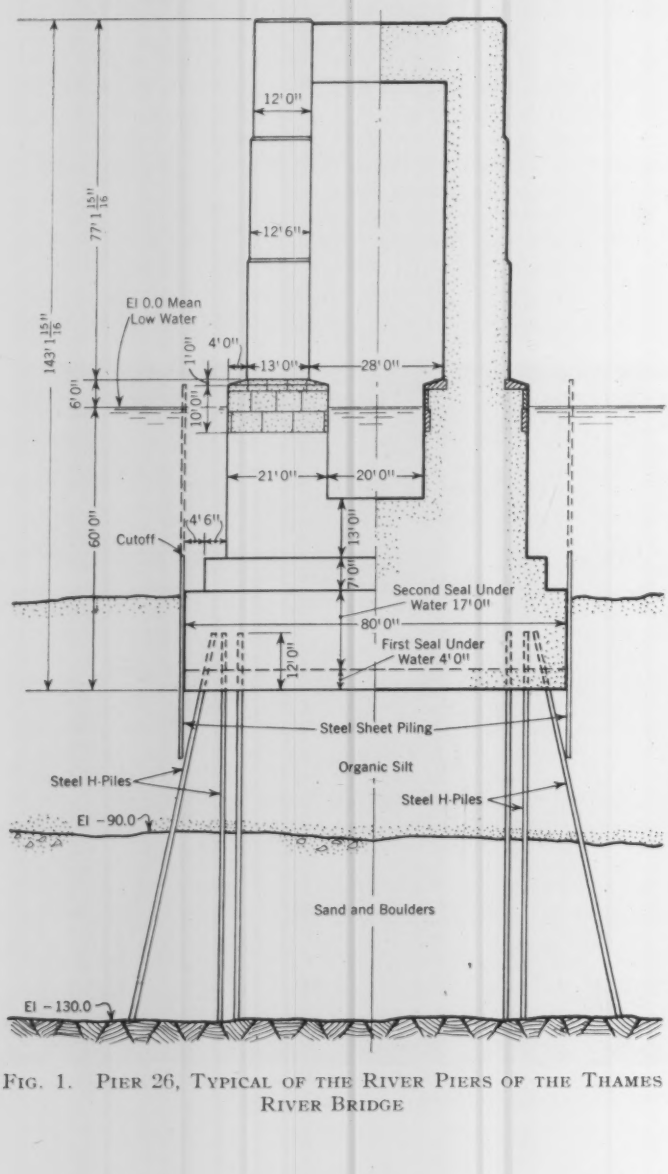


FIG. 1. PIER 26, TYPICAL OF THE RIVER PIERS OF THE THAMES RIVER BRIDGE

without a delay of several months. Accordingly, instead of cutting off the old sheet-piling under water and constructing a new cofferdam outside the portion of the structure already completed, the contractor elected to recondition the existing cofferdam.

COLLAPSED COFFERDAM REPAIRED

The first step was to straighten out the alinement of the top of the sheet-piling as much as possible and hold it in position by struts placed across the top of the piling from one side of the cofferdam to the other. The approximate position of the sheet-piling at this stage is shown by the dotted line on the plan view in Fig. 2. The individual sheets apparently had been bent inward just above the tremie concrete seal; and even after their tops had been pulled back they still encroached appreciably on the original clearance line of the cofferdam. However, the minimum clear space within the sheet-pile walls was greater than the required dimensions of the finished pier concrete above the footing slab. Examination by a diver showed that the sheet-pile interlocks were intact except at one corner near the bottom, but there were a few points where the webs of the sheets had been punctured by coming in contact with the projecting ends of the bearing piles.

After examining various methods for rebracing the cofferdam, the contractor adopted the following procedure:

An additional 16-ft tremie slab was placed within the sheet-piling in its distorted position. The total depth of tremie seal was thus increased from 21 to 37 ft, and the maximum depth of water in the cofferdam was reduced from 42 to 26 ft. Before the tremie concrete hardened, four steel H-piles to support the bracing were placed in a vertical position at about equal distances along the north-south axis of the cofferdam. Their lower ends were embedded in the concrete slab and their upper ends extended about 8 ft above the water level. After the tremie slab had hardened and its surface had been flushed free of laitance, the cofferdam was filled with $^3/_4$-in. crushed stone to about El. −10.

Two sets of timber bracing were constructed and set in place near the top of the sheeting. These were rectangular frames, about 28 by 70 ft in outside dimensions, having one longitudinal strut near the north-south axis of the pier and four transverse struts, with a maximum spacing of about 12 ft 9 in. Diagonal timbers were framed into the corners. The walers of the upper tier were 12-by-12 timbers, with 10-by-12 struts. The walers of the second tier were two 8-by-16 timbers laid flat, with 12-by-12 struts. The two frames were braced together vertically and installed simultaneously, so that the lower frame was in place below the water level.

The top tier ("A") of bracing was thoroughly blocked out to the existing sheet-piling by means of secondary timber walers in short lengths, following as closely as possible the irregular plan of the sheeting. A part of the sheet-piling did not extend up to the normal level of the top of the cofferdam, owing to its distortion. This was raised to full height by constructing a concrete cap on top of the sheeting where it was low. The top of the dam was then approximately uniform in height all around, almost 5 ft above the water level.

The water was pumped down until tier "B" of the bracing was exposed. This frame was then blocked out to the steel sheets in a manner similar to that described for tier "A." Special bracing was placed at the corners of the dam, where the sheet piles bulged outward in the form of projecting "ears," which were braced back to the main frame. The longitudinal struts of tiers "A" and "B" were held in place vertically by bolted connections to the vertical H-beams along the center of the pier. The walers of tier "B" were also supported by steel brackets welded to the sheet-piling.

FUNCTION OF CRUSHED-STONE FILLING

The water level in the dam was then pumped down to about El. −12, and the crushed stone was removed down to the same level. The function of this stone filling was to furnish interior support to the sheet piles at all times during the unwatering operations, thus reducing the unsupported lengths of sheets in resisting unbalanced water pressure.

Before tiers "A" and "B" were placed, steel waler beams and struts for the third and fourth tiers of the bracing had been dropped into place on top of the rock fill. When the fill had been removed to El. −12, bracing frame "C" was installed, with its center line at El. −11.5. This frame was made up of 24-in. I-beams for the walers and 14-in. H-beams for the struts. The walers were held in place by steel brackets welded to the sheet piles, to prevent twisting of the walers. Walers and struts were all welded together.

The water level was lowered and the crushed stone was removed down to El. −17.5 and bracing frame "D" was installed at El. −17, consisting of 14-in. 89-lb H-piles, with timber struts. After this frame was blocked out to the sheet piles, the remainder of the rock fill was removed and the dam was completely unwatered.

The procedure was completed with no serious difficulties. Leakage through the sheet-piling was moderate and was always under control. The sheet-piles were found to be appreciably distorted in places, particularly near the corners of the dam, but in no place was the interlock broken. Additional distortion of the sheet piles as the dam was unwatered was not appreciable.

With the cofferdam unwatered, construction of the pier inside the dam proceeded without any particular difficulty. After the footing slab was poured, the space between the slab and the sheet-piling was filled with crushed stone. The struts of tier "D" were then removed and the walers were cut apart. After the pier had been constructed up to El. −12, the crushed stone fill between the concrete and the sheet-piling was carried up to that level, and the bracing of tier "C" was released. The struts for tier "B" were "boxed" when the pier shafts were poured, and the walers braced from the new concrete.

When the cofferdam was finally flooded, tier "B" floated out, as it was constructed of timber. The steel beams of tiers "C" and "D" were then pulled out by means of steel cables previously attached. The sheet-piling was burned off under water just above the tremie slab. The rock fill placed around the lower part of the pier was abandoned.

In constructing Pier 27, the original design was followed, similar to that shown for Pier 26, in Fig. 1. The

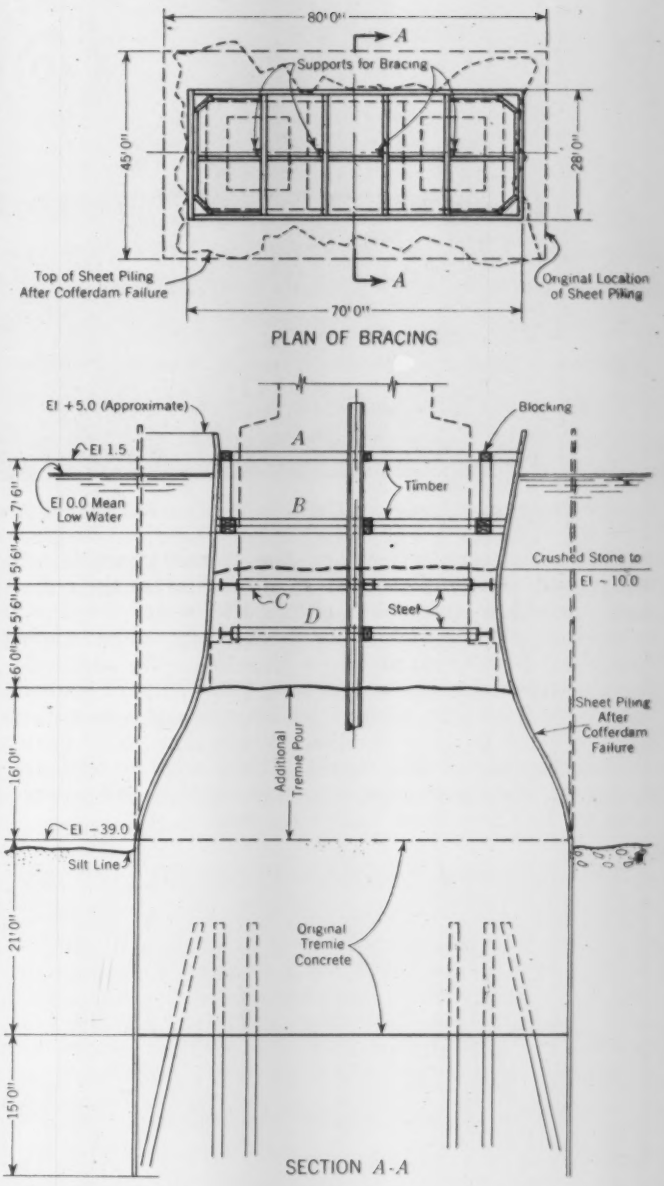
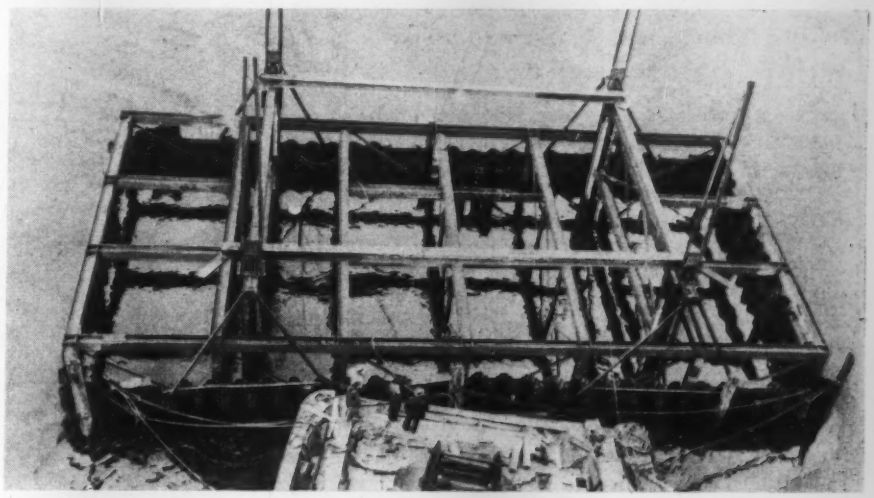
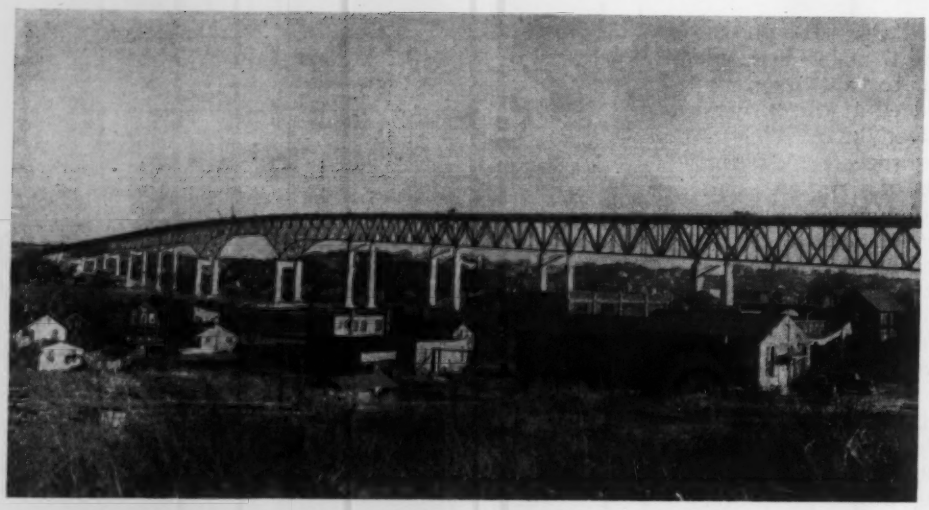


FIG. 2. REPAIR OF COLLAPSED SHEET-STEEL COFFERDAM FOR PIER 26



COFFERDAM FOR PIER 27—BRACING IS SUPPORTED ON FOUR COLUMNS DURING FABRICATION ABOVE WATER



THIRTY-TWO PIERS CARRY THE GROTON–NEW LONDON BRIDGE ACROSS THE THAMES RIVER

steel H-piles were driven and the tremie concrete seal was placed. A complete system of bracing for the cofferdam was then assembled above the water level and lowered into place within the sheet-piling. The bracing comprised four tiers, at El. +3, −12, −22, and −31. For the upper tier, the walers were two 12-by-12 timbers, one above the other, with 12-by-12 struts at a maximum spacing of 15 ft. On the three lower tiers, steel beams formed the walers and struts. They were braced vertically by steel posts and diagonal angles. All connections in the three lower tiers were welded.

METHOD USED FOR PLACEMENT OF BRACING FRAMES

The method developed by the contractor for lowering the bracing frames into place is of particular interest. These frames, when completely assembled, weighed about 150 tons. They were assembled, one tier at a time, above the top of the cofferdam, and lowered about 35 ft. During the lowering process, the bracing system was suspended at four points of support. To furnish this support, four steel columns were set on the tremie slab after the latter had hardened, with their tops about 12 ft above the top of the cofferdam. These columns, in pairs, were connected by steel trusses extending transversely across the top of the cofferdam. The top chord of each truss rested on top of the columns, and extended beyond them for a distance of about 3 ft. The projecting ends of the chord were braced to the top of the steel sheet-piling, and served as supports for the lifting apparatus.

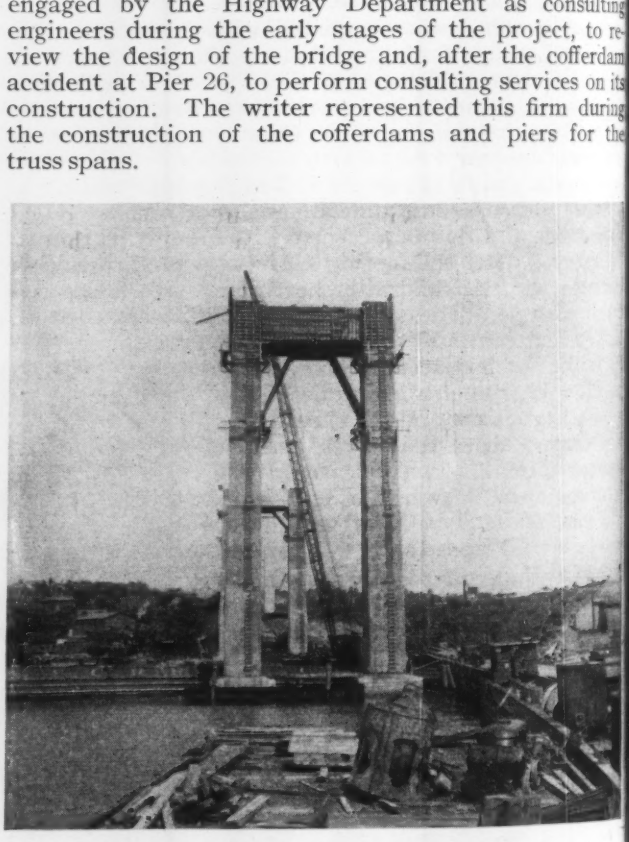
Four pairs of angles were attached to the lowest bracing tier, so as to straddle the supporting beams. Jacks placed on the beams engaged these hanger angles, and furnished a means for lowering the bracing system as a unit. After this system had been lowered into place, the cofferdam was unwatered. As only enough clearance had been provided around the bracing frames to permit lowering them inside the sheet-piling, the latter was pressed up against the waler beams, so that no blocking was required except at the lowest tier. Leakage was small, and unwatering of the cofferdam was completed without difficulty.

In constructing Pier 27 within the cofferdam, the steel struts of the bracing system were left embedded in the concrete. After the pier was completed above the water level and the cofferdam was flooded, the bracing struts were cut off under water between the pier shaft and the waler beams. Then the remainder of the bracing system was hoisted out of the cofferdam by means of the jacks and hanger angles which had been left in place.

Construction of the truss piers above the water level did not involve any particular difficulties except for the upper cross-struts at Piers 24 to 29, inclusive. These struts are quite heavy, and are so far above the base of the pier shafts that it was impractical to support the forms by vertical posts. Steel I-beams were placed to span between the completed pier shafts, and were supported on temporary seats bolted to the concrete. To reduce the deflection of these beams, they were given additional support at the third points by diagonal steel frames resting on needle beams, which had been embedded in the pier shafts.

As explained in a previous article, the Groton–New London Bridge is being constructed for, and will be operated by, the Groton–New London Bridge Commission. The bridge was designed by the Connecticut State Highway Department, which also provided engineering supervision and inspection during construction. William G. Brenneke, M. Am. Soc. C.E., was Project Engineer in charge of construction of the bridge for the Highway Department. The contractor for the substructure of the bridge was the A. I. Savin Construction Company, for which Burl A. Wilder and Clarence Sharpe were superintendents.

The firm of Parsons, Klapp, Brinckerhoff, and Douglas, represented by E. L. Macdonald, M. Am. Soc. C.E., was engaged by the Highway Department as consulting engineers during the early stages of the project, to review the design of the bridge and, after the cofferdam accident at Pier 26, to perform consulting services on its construction. The writer represented this firm during the construction of the cofferdams and piers for the truss spans.



FORMWORK FOR STRUTS SUPPORTED ON PIER SHAFTS USING KNEE BRACES

Geodetic Control Surveys Around Los Angeles

By ALFRED JONES, ASSOC. M. AM. SOC. C.E.

LOS ANGELES COUNTY SURVEYOR AND COUNTY ENGINEER, LOS ANGELES, CALIF.

COOPERATION among local and federal agencies has made possible the establishment of a geodetic control system in Los Angeles County, California. The U.S. Coast and Geodetic Survey, the California State Division of Highways, and the City and County of Los Angeles—through the bureaus concerned—all combined to carry out the plan. A triangulation network, extended from U.S.C. and G.S. first-order stations, is the basis for the 1,519 stations established throughout the county. This paper was presented by Mr. Jones before the Surveying and Mapping Division at the Los Angeles Convention.

LOS Angeles County, California, has solved the problem of perpetuating property boundaries by coordinating existing markers with a geodetic control system. The basis of this system is the network of triangulation maintained by the U.S. Coast and Geodetic Survey. Establishment of the system followed an investigation by a group of local engineers in 1932.

To gain a perspective of the situation as it existed at the time of the investigation, it is well to review briefly the history of land surveying in this area. Los Angeles County has a mainland area of 3,952 sq miles. Its physical characteristics range from coastal plain in the southern part to rugged mountain ranges extending generally southeast and northwest throughout the center section. In the northeast the county extends into the Mojave Desert. Elevations vary between sea level and 10,000 ft above.

Situated on the coastal plain are 44 incorporated cities, the largest of which is Los Angeles, the hub of the metropolitan area. Land values vary from a few dollars an acre in the more remote sections of the county to $18,000 a front ft in the heart of Los Angeles. Estimates made July 1, 1943, place the population of the county at 3,316,000.

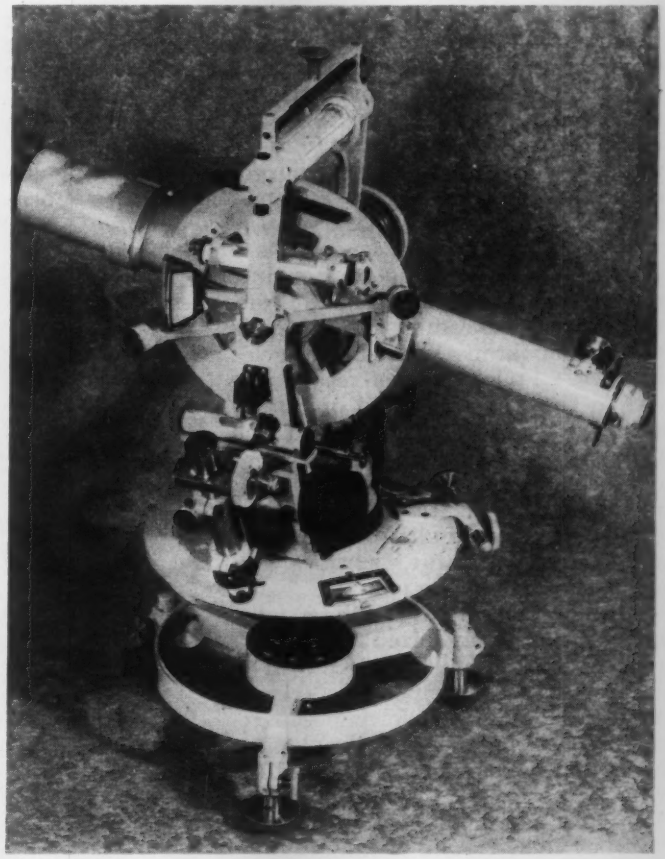
The Territory of California was under the control of Spain from 1769 to 1822. During the first fifteen years of this period absolute title to the lands was vested in the king. In 1784 the Spanish government recognized the necessity for private ownership of land, particularly for the pursuit of agriculture and stock raising, and from that time until the end of its jurisdiction, a few large grants were made to individuals.

EARLY LAND DESCRIPTIONS IN CALIFORNIA

In 1822 California became a province of Mexico, and so remained until it came under American domination in 1846. The Mexican regime recognized private ownership of land, and made numerous grants, called "ranchos," to individuals who enjoyed the favor of the various provincial governors. The descriptions of lands granted by both the Spanish and Mexican governments relied chiefly on the citation of various topographical features such as water courses, mountain ranges, and tide lands to correlate the documentary titles with their respective locations on the ground. Numerous ambiguities appear in these early descriptions, from which it appears that little if any actual surveying was done preparatory to drafting the grants.

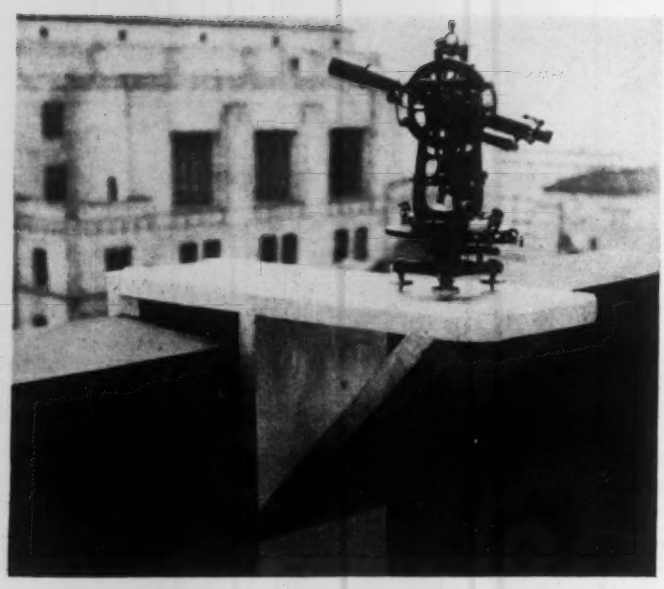
Following the admission of California to the Union in 1850, the U.S. Government adopted a policy of recognizing land titles granted by Spain and Mexico. In 1852 a commission was created through Congressional action for the purpose of settling private land claims within the state. This commission was vested with authority to investigate the land titles of the Spanish and Mexican eras, and to contract for boundary surveys and confirm land titles to claimants of grant lands. Government patents were issued on the basis of these boundary surveys.

Subsequently a large percentage of the public domain lying outside of these grants has been surveyed into townships and sections. The work of sectionizing is still in progress under the jurisdiction of the U.S. General Land Office. Until the early nineteen hundreds all surveys of this nature were performed by U.S. Deputy Surveyors on a mileage contract basis. As a general rule the contract fee for the survey of an entire township under this plan would hardly suffice to retrace the boundaries of a single section according to present-day standards. Numerous inaccuracies occurred in this early work, and many of the monuments marking the lines were of a perishable nature and have since been lost. Although the inconsistencies resulting from the contract system of surveys are evident, it must be recognized that a large percentage of the land titles in the state are based primarily on that system.



AN 8-IN. 2-MICROMETER HILDEBRAND THEODOLITE USED FOR ALL PRECISE WORK

These Instruments Read to Single Seconds Directly



SIMPLE OBSERVING STAND FOR USE ON BUILDINGS

Later subdivision and resubdivision of the ranchos and public lands, first into agricultural tracts and later into residential and business properties, have presented numerous complex retracement problems in Los Angeles County. Surveys for some of the older subdivisions were little better than the original contract work, often resulting in the creation of overlapping boundaries and the recording of conflicting data.

The problem of reestablishing and perpetuating the physical location of the original and subdivision corners has been inherited by the modern land surveyors practicing in this county. Its solution lies in the coordination of such corners to a geodetic control system based on the national network of primary triangulation established and maintained by the U.S.C. and G.S. Engineers recognize that this solution affords the most economical means at their disposal for the purpose of correlating uncontrolled and unrelated surveys and maps into a uniform system.

In 1932 an investigation of this problem made by a group of local governmental engineers, resulted in the recommendation that a geodetic control system be established covering the metropolitan area of Los Angeles County. Following this recommendation the County Board of Supervisors in May 1933 authorized the County Surveyor to proceed on a cooperative basis with other governmental agencies in the establishment of a primary triangulation system for the control of future surveys and maps throughout the county.

During that same month a joint committee was organized for the purpose of carrying out the plan. The committee was composed of representatives of the following departments and bureaus: (1) the County Surveyor of Los Angeles County, (2) the Los Angeles County Regional Planning Commission, (3) the Los Angeles City Bureau of Engineering, (4) the Los Angeles Bureau of Water Works and Supply, (5) the Los Angeles City Planning Commission, (6) the California State Division of Highways, (7) the Los Angeles County Flood Control District, and (8) the Metropolitan Water District of Southern California.

Owing to the difficulty of predicting the geographic trend of increasing land values, the committee adopted a general policy of conducting all field operations in accordance with first-order requirements of the U.S.C. and G.S. until such time as the spacing of control stations would permit their use in the final distribution of ultimate coordinate values to the cadastral structure by means of regular public works surveys.

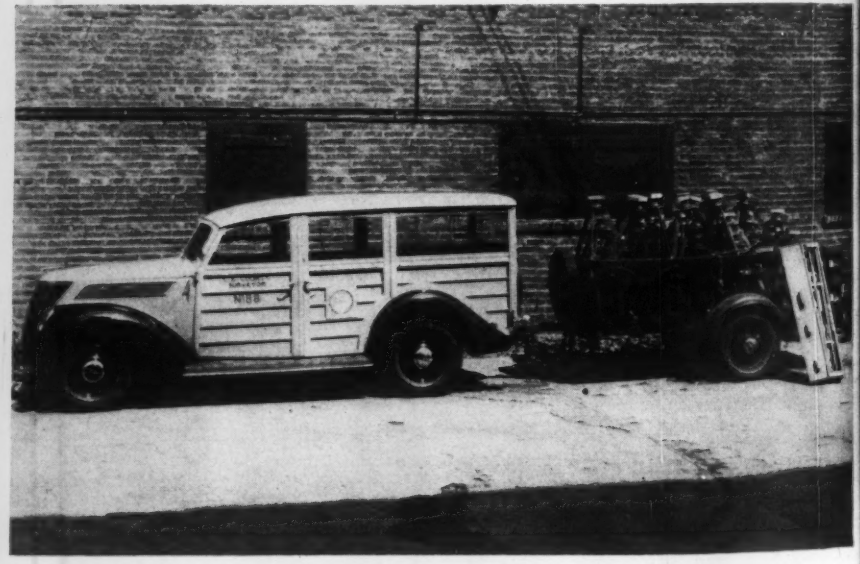
INITIAL SURVEY OF THIRTY-EIGHT STATIONS

Immediately following the authorization of this project, field operations were commenced by a survey party organized from personnel of four of the cooperating agencies. The reconnaissance resulted in the design and adoption of a triangulation network containing 38 stations, including 5 first-order stations of the U.S. Coast and Geodetic Survey.

Substantial station and reference monuments were set at each location. The typical monument consisted of a 4-in. bronze disk set in a large concrete pier cast in place. A subsurface monument of durable quality was also set approximately 12 in. below the base of each triangulation monument. Reference marks were similar in construction to the triangulation monuments.

Near the center of the network, a precise base line approximately 5.3 miles long was measured by the joint survey party. In the subsequent adjustment, the geographic positions of the 5 primary stations, together with the measured length of the base line, were held fixed. Angular observations were made at night using an 8-in. 2-micrometer Hildebrand direction theodolite, reading to single seconds. In the measurement of the base line, three 50-meter invar tapes certified by the National Bureau of Standards were used.

Incidental field equipment such as heliotropes for reconnaissance, signal lights, instrument stands, and towers for angular observations, and taping stands and center support for base-line measurement, were built by personnel of the cooperating agencies. The method of least squares was employed in the adjustment of observations, the computations being performed by an office staff also selected from the regular personnel of the co-



TO CARRY EQUIPMENT FOR THE SURVEY PARTIES, SPECIAL TRAILERS WERE CONSTRUCTED AND ATTACHED TO STATION WAGONS

operating departments. Geodetic positions were based on the North American 1927 datum.

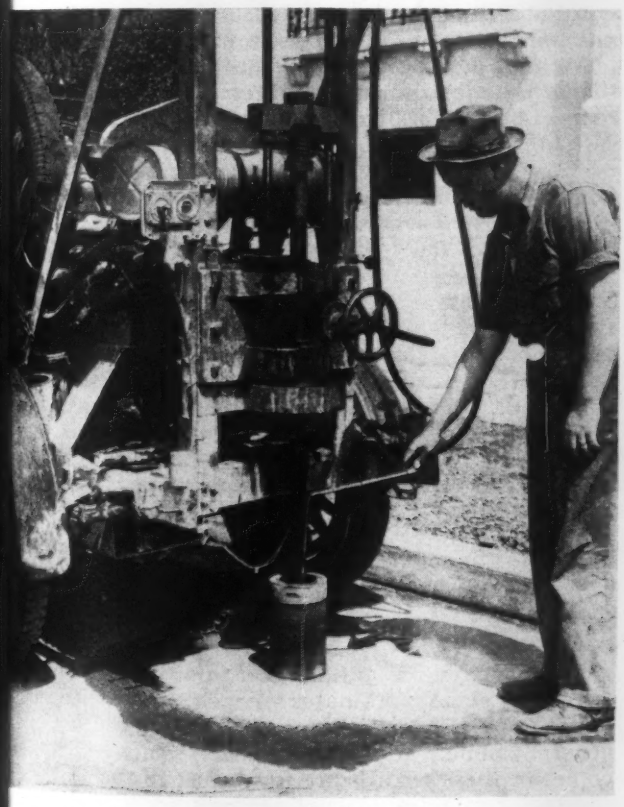
The following tabulation reflects the degree of precision obtained in the initial 38-station survey:

Total number of triangles	167
Number of triangles fixed by the U.S.C. and G.S.	5
Number of triangles with plus closures	85
Number of triangles with minus closures	76
Number of triangles with flat closure	1
Number of concluded triangles	0
Number of triangles with more than 3-sec closure	3
Average closure of triangle without regard to sign	1.14″
Maximum triangle closure	3.53″
Mean error of angle	0.80″
Probable error of an observed direction	0.50″
Number of bases	3
Agreement between bases	1:104,500 1:380,000
Number of bases measured	1
Probable error of measured base	1:2,900,000

The lengths of the two base lines held fixed in the length equations were triangulated values between first-order U.S.C. and G.S. triangulation stations as reported by that bureau.

PLANE-COORDINATE PROJECTION

Upon completion of the adjustment, in February 1935, plane coordinate values based on the polyconic system were computed for each station. The controls and the origin of the coordinates adopted for this projection were made to conform with a system in use at the time by the Los Angeles Bureau of Water Works and Supply. To adapt this system of projection to the entire area of the county necessitated the establishment of two additional grid zones, in order to maintain a consistent relationship between projectional accuracy and the accuracy of contemplated field operations.



7-IN. CORE DRILL CUT PAVEMENT OPENINGS FOR MONUMENTS

TAPING STAND USED IN PRECISE TRAVERSE AND BASE-LINE MEASUREMENTS
The Rod Has a Circular Level Vial in Upper End

In 1936 the U.S.C. and G.S., through its Special Publication No. 202, established a uniform system of plane coordinates for California. The Lambert conformal projection was adopted by the Government in this publication for basing plane-coordinate values throughout the state. The state was divided into six zones, the boundaries of which conform with county boundaries, Los Angeles County being located in Zone 5. Results of our 38-station survey previously described, were embodied in Special Publication No. 202.

Since this publication created a plane-coordinate system at variance with the one in local use at the time, it caused a rather complex problem. The principal complication was that local engineers were given the choice of using either the state Lambert system or the local polyconic system for coordinating their surveys and maps, a condition diverging from the primary function ordinarily afforded by geodetic control. A comprehensive study and analysis of the problem was made by the joint committee and was submitted in 1938 to the late Maj. William Bowie, then retired Chief of the Division of Geodesy, U.S. Coast and Geodetic Survey.

LAMBERT CONFORMAL PROJECTION ADOPTED

One of the factors for consideration was that a considerable amount of federal and local funds had already been expended on a cadastral mapping project coordinated to the polyconic system. Fortunately the mapping which had been completed at that time was all located in the central polyconic zone. In his analysis, Major Bowie pointed out that the polyconic system in local use was not as well adapted to survey and map control over the entire county as the Lambert system, since it involved the use of three separate grid zones. He foresaw some future difficulty in coordinating surveys which overlapped zone boundaries.

Following his analysis he recommended that we consider adoption of a conformal type of projection which would embody the following characteristics: (1) inclusion of the whole county in a single zone, (2) selection of the origin of coordinates and central meridian so that remapping would be unnecessary, and (3) spacing of the standard parallels or meridians in such a manner as to produce scale factors so small that they could be considered negligible in ordinary survey work.

The joint committee, acting on Major Bowie's recommendation, adopted a single-zone Lambert conformal projection embracing the entire county. All the fea-

tures proposed by him were embodied in the new grid. The transition between systems required the minimum of expenditure, since it necessitated only the recomputation of plane-coordinate values for 525 stations and the retyping of these data on new cards.

Considerable expense was saved local governmental agencies through the cooperation of the U.S.C. and G.S. In addition to assisting us in analyzing our problems, that bureau prepared and furnished a complete set of tables for computating plane coordinates according to the new system.

EXTENSION OF THE INITIAL SURVEY

On completion of the initial 38-station survey in 1935, the County of Los Angeles adopted a cooperative policy toward various local municipalities interested in coordi-

A PRECISE TAPING PARTY WITH ITS POLICE ESCORT

nated surveys and maps, a policy which is still being followed. This has enabled a number of our cities to take advantage of our precise equipment and specialized personnel in obtaining accurate control for their various public works operations. Through joint action of the County Board of Supervisors and municipal governing bodies, we have been able to extend this service to 17 cities within the county. Also, our program of operation has on seven different occasions been scheduled to accommodate local engineers engaged in subdivision development of large tracts of land.

All geodetic operations since 1935 have consisted of a further breakdown and extension, both by triangulation and traverse, of the initial 38-station survey. The Bureau of Engineering of the City of Los Angeles has also made notable progress with coordinated surveys during this period. Its operations, originally confined to the San Fernando Valley, have recently been shifted to the more congested districts to provide control for a system of freeway surveys contemplated for immediate and postwar construction. Both the County and the City of Los Angeles have employed only first-order methods of triangulation and traverse in extending this coordinated survey work.

Since the declaration of war, angular observations have by necessity been made in the daytime, using regular signal lights for targets. Excellent results have been obtained when atmospheric conditions have been good. However, it has been noted that in order to secure first-order azimuth closures, the percentage of re-occupations has slightly increased. All triangulation breakdown has been adjusted by the method of least squares, whereas the method of simultaneous weighted junction points has been employed in the traverse computations.

Cooperation by various municipalities in which t angulation and traverse surveys have been made h been excellent. They have furnished both men and m terial for carrying on the work, and in each instance reg lar police officers have been assigned to our taping par to control highway traffic. Through the efforts of th U.S. Coast and Geodetic Survey our invar tapes ha been periodically standardized by the National Bureau Standards.

At the present time 1,519 triangulation and traver stations are available for use in Los Angeles Count Of these, 618 have been established by the City Engine of Los Angeles. Triangulation stations in the part the county lying south of the San Gabriel Mountains a distributed on an average of one for every 3.3 sq miles.

Of special interest in connection with the extension the initial survey has been the development of speci equipment to expedite the work. Control monuments paved streets have been set several inches below sub grade and protected at the surface by a cast-iron cove weighing 26 lb. A 7-in. core drill equipped with an ove sized attachment developed by the Los Angeles Cit Testing Laboratory has been employed in cutting th pavement for setting these monuments and seating th covers. For carrying the precise taping equipment, light-weight trailer for use with a station wagon was de signed and built. This has proved very economical sinc it released for heavier duties a larger truck of equal capa ity which formerly had been used for this purpose.

Also developed during the progress of the work was device for plumbing taping stands over preliminar ground stations. This consists of a $^1/_2$-in. brass rod 3 long with a circular level vial attached to one end. Th opposite end is pointed. To operate, the pointed end passed through a hole in the top of the stand and brough into contact with the ground station. The stand is the shifted to the point where the bubble is centered. Thi device is more rapidly operated than the ordinary plumb bob and attains the degree of accuracy required for roug plumbing.

Another development was the construction of a can tilever-type instrument stand for use at stations on th roofs of buildings. This stand, constructed of 2 by 14-i sugar pine, so designed that it is readily clamped to th fire wall of a building by means of set screws, has bee successfully used at numerous stations for supporting th direction instrument without noticeable loss of precisio in observed values. No other structure or platform ordinarily needed for the observer.

Considerable time in office operations has been save through the use of a special calculating machine which designed to add or subtract angular values recorded degrees, minutes, seconds, and hundredths of second This machine was furnished by the manufacturer at th same cost as his standard adding machine. Its use particularly valuable in setting up angle equations an in computing triangle closures and traverse bearings.

DISSEMINATION OF INFORMATION

In 1935 the joint committee designated the Count Surveyors Department as a clearing house for geodet control data reported by the various governmental an corporate agencies. Since then this department h maintained a file of station descriptions, geographic po tions, and plane coordinates for each station. This info mation is typed on 5 by 8-in. cards for the use of th general public. As they become available, photostat copies of these records are forwarded to the Director the U.S. Coast and Geodetic Survey for his informatio and files.

Roadway and Intersection Capacity

Survey of Representative Localities Used as Basis of Traffic Study

By Guy Kelcey, M. Am. Soc. C.E.

Highway Analyst, Port of New York Authority, New York, N.Y.

Throughout the country, post-war planning is occupying the attention of highway engineers. Although present traffic is straining existing facilities in only rare instances, objective planning is anticipating the peak loads to come. This analysis by Mr. Kelcey was made prior to the dislocations of the past two years and represents the most recent studies made of normal heavy-traffic conditions.

Efficient traffic flow on streets and highways is necessary if satisfactory transportation is to be provided. In adapting existing roadways and designing new ones to carry present or anticipated traffic loads, it is necessary to measure rates of vehicle flow, to calculate roadway capacities, and to compare these measurements with acceptable standards. To provide a basis for such measurements, several factors need to be taken into consideration.

The measure of traffic flow on roadways is frequently expressed in terms of the total flow of vehicles, in both directions, for a given period, such as for 12, 16, or 24 hours. While such information is interesting as one means of economic measurement, it is not useful in solving specific problems of peak-load traffic demands which confront transportation officials and traffic engineers in practice. Thus, a 16-hour count of 2,000 vehicles along a roadway may indicate serious problems of congestion if most of these vehicles are concentrated in brief periods, in alternating directions. On the other hand, a 4,000-vehicle load on the same roadway presents no problem of congestion if it is uniformly distributed in both directions over a 16-hour period.

Roadways and roadway intersections must be considered in terms of their capacity to accommodate the peak loads to which they are, or will be, subjected. While it tends to follow an hourly, daily, and seasonal pattern, traffic flow normally ebbs and surges unequally, alternating in direction, and peak traffic loads are usually in one direction at a time and for relatively short periods.

In practice, the curve of the usual traffic load fluctuates from low valleys to lofty peaks with few plateaus and often with extreme variations. When a peak traffic load exceeds the capacity of the roadway facilities for its accommodation, or of adequate facilities that are inefficiently used, it develops a false peak or "back-up," not only along the course of the heavy flow, but in other directions. This "back-up" is a form of congestion that is usually characterized by inefficient movement and often requires longer to loosen up and free itself than does the period of heavy peak load that created it. Indeed, "back-up" congestion arising from an interval of heavy load often gives the impression of over-load in directions where none actually exists, and when the traffic load is actually normal or subnormal. If the peak load is accommodated, the aftermath "back-up" congestion will be avoided.

Measurements of peak traffic loads, of rates of flow, and of the capacity of roadways are necessary if a given condition is to be correctly appraised and if a satisfactory solution is to be approached. A suitable basis for measuring the rate of vehicle movement is in terms of vehicles per traffic lane per hour. This may also be expressed as seconds of headway, per vehicle, per lane.

Basis for Measurement

The establishment of a practical standard of flow perfection requires an arbitrary generalization. Assume a perfect roadway, without impediments, intersections or interruptions, with ample reservoir accommodations at both ends to discharge and receive the flow of vehicles, on which travel perfectly trained drivers in perfect cars. Under such ideal conditions, it might be possible for a vehicle, per lane, to pass in each 1.2 seconds, or 3,000 per lane per hour. This arbitrary figure is here adopted as representing 100% efficiency, for use in comparing actual rates of flow per lane per hour under other circumstances, where various elements of perfection are lacking. Such a rate is not likely to be exceeded, although it might be approached for short intervals under favorable conditions.

A canvass of highway and city traffic experience indicates that the normal maximum practical expectancy

Public Roads Administration

Congestion Resulting from Inadequate Outlet Facilities on 14th Street, S.W., Washington, D.C.

Yale Bureau Street Traffic Research

ELABORATE BUT EFFECTIVE IS THIS TRAFFIC INTERCHANGE ON NEW YORK CITY'S WEST SIDE HIGHWAY

per lane per hour for uninterrupted flow, under favorable roadway conditions, is approximately 1,600 vehicles. This seems to be a critical point beyond which confusion and other interferences are apt to precipitate back-ups and congestion. It is entirely probable that widening of roadway lanes, use of white lines to define them, further improvements in vehicles, better driving, and better feeder and discharge facilities to and from main roadways will gradually increase this figure.

HIGH TRAFFIC COUNTS RECORDED

Indeed, a New York City parkway count showed as high as 2,193, and for a brief interval a Chicago Park District count recorded 2,043 cars per lane per hour. In one Chicago Park District count, the average flow per lane per hour for four lanes in one direction, during a peak period, was 1,960, or 7,840 for the four lanes. Counts for short intervals have been reported, but not confirmed, of 2,800 cars per lane per hour. These maximum flows are reported to have been achieved where speeds were between 30 and 40 miles per hour.

Of far greater importance than the maximum possible flow are the conditions that prevent efficient flow, particularly at intersections. In fact, the first part of this article is intended as an introduction to a discussion of these conditions. There are many impediments to the attainment of perfection in traffic flow even on open highways with all grades separated. In spite of much improvement, drivers as a whole do not always function correctly; some are slow, some are hesitant, and some, who are inexpert, cannot maintain pace. Each has a different reaction time and accordingly drives close to, or well away from, the next vehicle. Others fail to keep in line and occupy, or block, double-lane space. Not all vehicles are in condition to meet operating demands.

Even the best highways, with adequate lane widths, usually lack accommodations for feeding vehicles onto, or discharging vehicles from, the roadways at full capacity per lane per hour. Again, few roadways are so well designed and maintained that maximum traffic flow is attained. Pavement defects, short curve radii, inadequate visibility or sight distances, narrow lanes, turning movements, parking, pedestrains, inadequate direction signs, and other factors cause hesitation on the part of drivers and other disturbances that prevent efficient traffic flow.

Intersecting streams of traffic at grade introduce the major single problem in the maintenance of good traffic flow. When grades are separated, as at clover-leaf interchanges, each traffic lane is free to carry its load without interference from crossing vehicles. When, however, two roads intersect at grade, the flow cannot exceed 50% of the total capacity of the feeder lanes. Similarly, at the intersection of three routes, the capacity of the intersection cannot exceed one-third of the capacity of all the routes.

These maximum-capacity percentages are further reduced by a number of other factors, some of which are constant and some extremely variable. Simple interferences include those introduced by pedestrians, right and left turns, and other secondary factors, all of which reduce the percentages given for the maximum overall capacity of intersections at grade. The most serious loss usually develops from the necessary and frequent reversal in the direction of traffic to accommodate crossing movements.

When the direction of flow at an intersection is reversed to permit movement of cross traffic, an interval of time

Yale Bureau Street Traffic Research

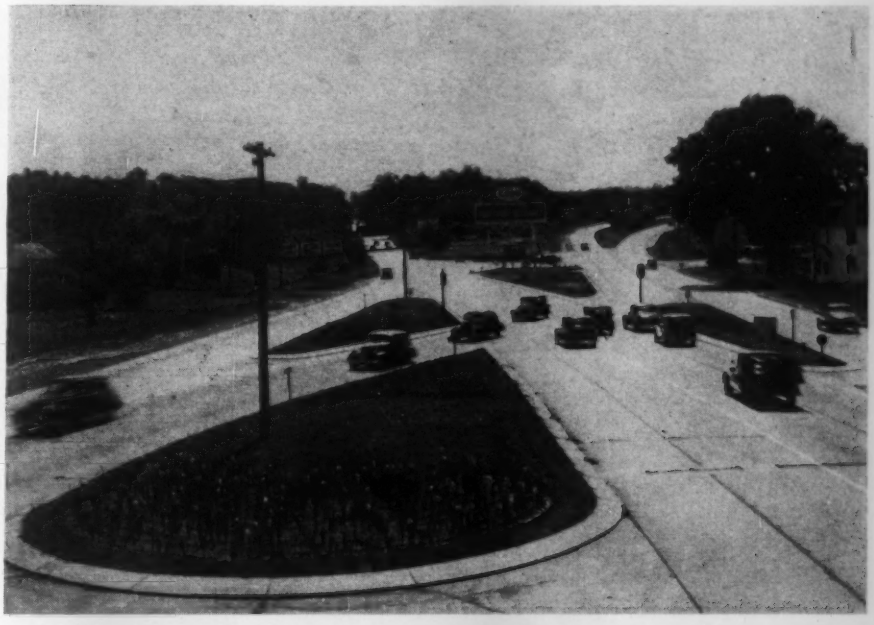
LANE MARKINGS AID IN EFFICIENT USE OF ROADWAY

must be allowed so that cars already in motion can clear the intersection. At the beginning of the clearance interval, the intersection is fully in use or usable. At the end of the clearance interval, it is completely out of use and is empty of traffic. In terms, then, of intersection capacity to carry the vehicle load, half of the clearance interval is lost time. Clearance intervals normally range from 3 seconds at intersections of relatively narrow roadways, to 5 or more seconds where roadways are wide or where the crossing distance is greater because the roadways intersect at an acute angle. The Chicago Park District reports that 4.76 seconds is its average clearance interval for a 66-ft roadway.

A second loss of capacity occurs at the end of the clearance interval, while cars that have been stopped get under way. If these cars start instantly, they normally require at least the time of a full clearance interval to refill the intersection. At the beginning of this time the intersection is empty and at the end it is fully in use. Half of this interval is, then, also lost.

Thus, for each reversal of traffic flow, an amount of time equal to at least a full clearance interval is lost in clearing and refilling the intersection. Since there are two, and sometimes three, clearance intervals at an intersection during each cycle, from movement in one direction back to movement in the same direction again, and since the time of one clearance interval is definitely lost during each reversal, the total of two clearance intervals is lost to the free flow of traffic, per cycle, at the intersection of two roadways, and three clearance intervals are lost per cycle during a three-interval movement or cycle of operation.

Another, but variable, loss arises from "inertia lag," or delay in getting started. Thus in starting on a green signal, stopped cars often "accordian" out so that in extreme cases the signal ahead changes back to red before the last cars in the line can move. Given efficient drivers, this lag is reduced, but it always constitutes a considerable and unavoidable loss in intersection capacity. The total time lost per cycle, therefore, from movement in one direction back to movement again in the same direction, equals the clearance intervals plus the time lost after each reversal owing to delay in starting.



Public Roads Administration

CHANNELIZED INTERSECTION REDUCES INTERFERENCES TO TRAFFIC

SOME APPROXIMATIONS

Assume a simple right-angled intersection at which the normal traffic flow is in the ratio of 60% on the main roadway and 40% on the cross roadway. The generally accepted, practical maximum of traffic flow to be expected per lane per hour, when there are no interruptions or impediments is 1,600 vehicles per lane per hour.

Assume that an intermediate or change interval of 3 seconds is allowed at each reversal of direction of intersecting traffic. Then two reversals, or 6 seconds, are lost per cycle. This equals 10% of the cycle time if a 60-second cycle is used. An equal amount of time is lost through lag in starting. This amounts to a total of 20% of the cycle time. The maximum time available for actual traffic movement in both directions is then 100% minus 20%, or 80%. If 60% of this 80% is allocated to flow in the direction of heavy traffic, then the maximum actual time available for movement in this direction is 48%. Applying this percentage to a flow of 1,600 cars per lane per hour, which is taken as the practical maximum under nearly perfect conditions, the result is 768 cars per lane per hour, as the maximum that can be expected in the direction of heavy flow. This applies where the traffic loading is in the ratio of 60% main flow and 40% cross flow.

Similarly, at the intersection of three roadways, the

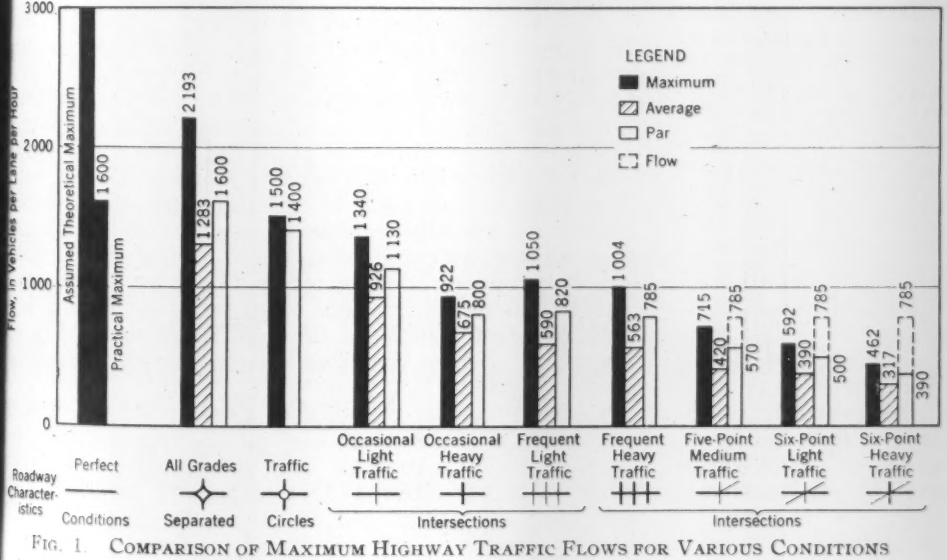


FIG. 1. COMPARISON OF MAXIMUM HIGHWAY TRAFFIC FLOWS FOR VARIOUS CONDITIONS

Public Roads Administration

COMPLICATED INTERSECTION AVOIDED BY USE OF TRAFFIC CIRCLE, NEAR NEWARK, N.J.

maximum practical capacity can be calculated. Assume such an intersection with traffic distributed equally so that each flow of traffic is allotted one-third of the time available for movement. Since approximately 30% of the total time is lost in reversals, leaving 70% for total useful movement, flow in each direction would be given $23\frac{1}{3}$ of the useful time. Applying this percentage to the 1,600 maximum practical expectancy of flow per lane per hour, the result is 373 vehicles in each direction.

TABLE I. CAPACITY OF INTERSECTIONS CONTROLLED BY SIGNALS

(a) Intersection of Two Roadways, Two-Interval Cycle of Operation

PERCENTAGE OF TOTAL TIME GIVEN TO		MAXIMUM EXPECTANCY, VEHICLES PER LANE, PER HOUR	
Main Street	Cross Street	Main Street	Cross Street
50%	50%	640	640
55%	45%	704	576
60%	40%	768	512
65%	35%	832	448
70%	30%	896	384

(b) Intersection of Three Roadways, Three-Interval Cycle of Operation

PERCENTAGE OF TOTAL TIME GIVEN TO			MAXIMUM EXPECTANCY, VEHICLES PER LANE, PER HOUR		
Street No. 1	Street No. 2	Street No. 3	Street No. 1	Street No. 2	Street No. 3
$33\frac{1}{3}$%	$33\frac{1}{3}$%	$33\frac{1}{3}$%	373	373	373
40%	30%	30%	448	336	336
40%	35%	25%	448	392	280
40%	40%	20%	448	448	224
50%	25%	25%	560	280	280
50%	30%	20%	560	336	224
60%	20%	20%	672	224	224

Calculations by this method yield the flows shown in Table I. These flows represent the practical maximums obtainable where impediments introduced by left turns, pedestrians, improper driving, and other factors have been eliminated. These figures may therefore be taken as a goal to be hoped for as impediments are eliminated. An example of such an impediment is reported by the Chicago Park District, which counted an uninterrupted flow of 200 cars per lane per hour on $8\frac{1}{2}$-ft lanes, at an average speed of 15 miles an hour. On 11 and 12-ft lanes, with no interferences, the District's maximum working figure is 1,600 cars per lane per hour. Thus the restraint introduced by lanes that are too narrow, giving too little leeway, reduces the flow of traffic by 900 vehicles per lane per hour. To check these deductions it was decided to canvass and record actual peak flows under various conditions. Accordingly traffic engineers in all parts of the country were canvassed to determine flows under peak-load pressure for a range of traffic conditions. Survey results are given in Fig. 1.

It is obvious, of course, that if all cross flow is cut off at an intersection, and if all impediments are removed, the main flow could approach, and under some conditions could exceed, the normal expectancy of 1,600 cars per lane per hour. The lower figures recorded are chargeable principally to cross flow and other interferences. Taking the approximate percentages presented previously in this article, and ignoring secondary interferences, it is possible to calculate roughly the maximum flows that may be hoped for at various types of roadway intersections under favorable conditions.

Having established the flow that a roadway or an intersection should carry per lane per hour in the direction of heaviest load, interferences that prevent its attainment can be determined and, as far as possible, eliminated or relieved. Such steps obviously include careful balancing of signal timing and coordination of signals to produce continuous movement of platoons of cars so as to eliminate or reduce the lag in stopping and starting. White lines to define lanes entering and leaving intersections, facilitation of turning movements, and many other similar steps are well known, but too little used, methods of improving flow efficiency.

It should be emphasized particularly that many intersections of three roadways are capable of channelization treatment to eliminate irregular movements, to reduce the length of shuttling maneuvers, to simplify problems of interchange of vehicles and pedestrians, and to permit operation on a two-interval rather than on a three-interval cycle where it is necessary to use traffic signals. Five-point and six-point intersections can often be channelized to simplify vehicle movements so that main-flow efficiencies equal to those of normal intersections can be attained, as indicated in Fig. 1 by dotted lines. Indeed, many intersections of all types can be channelized to greatly increase flow efficiency and safety of operation—results that follow from the efficient use of roadway space.

Certainly if the capacity of existing roadways, and particularly of intersections, can be substantially increased by adjustments and inexpensive procedures such as those outlined, then expensive additions and widening operations can be avoided. Such methods should also aid in meeting traffic pressures arising from wartime demands.

Drafting Consumer Rules for Water Services

From Paper Given Before Sanitary Engineering Division at Society's Los Angeles Convention

By MAX K. SOCHA

ASSISTANT ENGINEER OF DESIGN, DEPARTMENT OF WATER AND POWER, WATER SYSTEM, LOS ANGELES, CALIF.

ENGINEERS and administrative officials charged with the responsibility of supplying a community and its inhabitants with an adequate water supply must inevitably be concerned with the task of drafting consumers' rules and regulations for the service rendered. These regulations largely incorporate administrative and fiscal policies concerned with the relationship between the water utility and the consumers.

Proper control of the expansion of water system facilities in new subdivisions requires the cooperation of various city departments. The city engineer, city planning commission, or other jurisdictional bodies should require that arrangements be made for the installation of a complete water system, including fire hydrants in the new areas before such areas are recorded. This will require the installation of water mains, service and fire hydrants before the new streets have been developed, and will avoid the economic waste which occurs when newly placed pavement has to be cut through because of lack of foresight in planning for the necessary utilities.

IDEAL CONDITIONS FOR LAYING MAINS IN NEW SUBDIVISIONS EXIST WHEN STREETS HAVE BEEN LOCATED AND GRADED, AS WAS THE CASE IN THIS LOS ANGELES DEVELOPMENT

On the other hand, such facilities should be installed in new subdivisions only after streets are well defined and marked with proper survey stakes, and preferably after curbs have been placed. The streets should be graded to subgrade before the facilities are installed. Moreover, such facilities should only be installed in property owned by the city or in streets formally dedicated to public use, unless a right of way or easement is granted to the utility. In private or non-dedicated streets, the rules should require that the street alinement and grade be established by the city engineer before the installation of mains.

PRESSURE CONDITIONS

It is the duty of water works engineers to maintain a reasonable range of pressure fluctuation within service zones. An unusually large pressure range indicates system weaknesses that should be corrected by the utility. The consumer has the right to expect a reasonable and predictable range, known to him at the time the service is ordered, and this range should remain substantially unchanged.

After a reasonable pressure range has been established within a service zone, all applicants for water service should be required to accept it, and at the same time, to hold the utility harmless from any damages caused by fluctuations of pressure or interruptions in service. An applicant for a service connection should be required to agree to accept such service as the utility is able to render from its existing distributing system and to construct, if necessary, and maintain at his own expense, regulating devices such as a tank to furnish an auxiliary supply when pressure may be insufficient, or a pressure regulator to reduce excessive pressures.

These provisions should not be abused by the utility. The consumer still has the right to expect reasonable pressure conditions and the utility should undertake, at its own expense, any system betterments that are necessary to maintain the proper range of pressure. When the utility desires to increase the pressure in mains, and consumers are adversely affected, individual pressure regulators should be installed on the service connections at the utility's expense.

Water piping ordinances usually determine the size of service connections. Subject to the limitations of such building ordinances, the utility should reserve the right to determine the size of the consumer's service connection and its location. Each building under separate ownership should be provided with its own service connection. In no event should two or more service connections serving a consumer's premises from the same or different mains be allowed unless check valves are installed to assure that flow cannot pass from the public water system through the consumer's piping system and back into the public system.

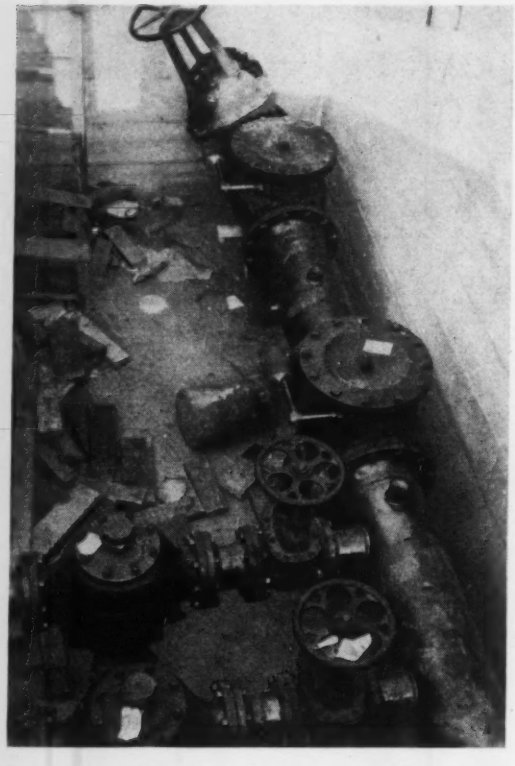
It is useless for the utility to try to provide for adequate water service if the consumer's piping system is inadequate to take care of the requirements of his property. Positive control of the adequacy of consumer's piping lies within the jurisdiction of the city's department which establishes design requirements, issues building permits, and inspects construction work. This department should require piping of sufficient size and capacity to produce a specified minimum pressure at the most remote fixture, to insure required rates of flow for the various uses and types of fixtures, and to eliminate all possibility of vacuums and contamination caused by backflow or back-siphonage.

A water piping ordinance should be drafted in close cooperation with the utility engineers, for it is only through proper control of the consumer's piping that the utility can be assured that adequate service will be rendered and the purity of the supply protected.

A large number of water meters are damaged by hot water or steam emanating from the premises. This dif-

ficulty may be caused either by mechanical failure of hot water heaters or by carelessness of the consumer in operating the heaters. In severe cases, not only has the meter on the consumer's service connection been damaged, but hot water has traveled through the mains and damaged meters on the services of adjacent property owners.

In view of the fact that hot water or steam damage is usually caused by failure of mechanical equipment or ignorance of the consumer as to the effect of hot water on meters, it is recommended that in the interest of good consumer relations, the utility assume the cost of changing and repairing a meter the first time it is damaged. A notice should be mailed to the person responsible for the payment of water bills informing him of the damage and explaining the effect of hot water or steam on water meters. If the damage occurs again, and the same person has been continuously responsible for the payment of water bills since the date of the last occurrence, then the cost of changing and repairing the meter should be charged to this person. Hot water damage to meters can be eliminated to a large extent if the city's piping ordinance requires a check and pressure relief valve installed on the outlet side of the water-heater control valve.



INDUSTRIAL SERVICE CONNECTION PROTECTED BY DOUBLE CHECK-VALVE INSTALLATION

HEALTH REGULATIONS

War industries have heightened the hazards of cross connections between drinking water and auxiliary water supplies or carriers of other dangerous waters. Investigations have disclosed numerous instances of cross connections between drinking water systems and other systems. Some of these are a menace to the health of consumers both on the premises and elsewhere.

Regulations can establish controls over the operation of dual water supplies, fire systems, industrial process water, and waterfront lines. These regulations should encourage the exclusive use of public sources of water supply where they are available, and discourage the use of other sources unless they are of good quality and under competent sanitary supervision. Wherever practicable, it should be required that water systems for fighting fire, for industrial processes, for sewer and sewage treatment plants, and for fire-protection lines supplying vessels at piers, should be wholly separate from lines carrying drinking water. Pending such separation, contamination of drinking water must be avoided by the use of devices to prevent backflow.

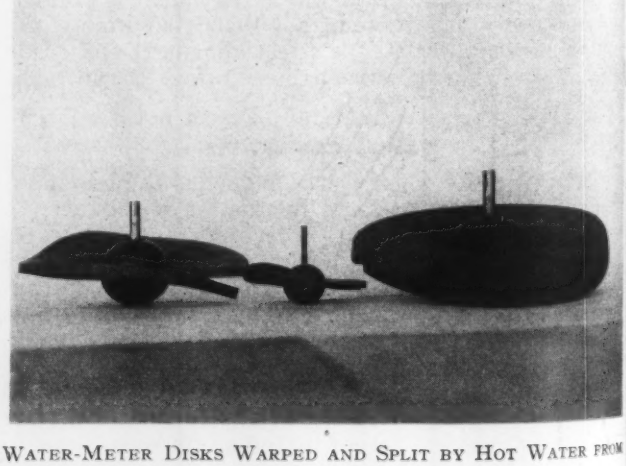
Wherever practicable, an air-gap separation between the drinking water system and the process water or fire-fighting system (if other than an approved source is used for this purpose) should be used in preference to mechanical equipment for preventing backflow. Where air-gap separation is impracticable, or would require the use of a large amount of critical materials, suitable approved double check-valve installations should be provided. Devices for preventing backflow must be inspected by the owner at least every three months, and serviced or replaced wherever they are found defective. The utility usually owns, controls, and services one check valve and the other is under the jurisdiction of the consumer, although many utilities are adopting the practice of installing and controlling both check valves.

Regulations should also provide for marking exposed portions of dual water systems and for posting outlets to indicate which are safe and which unsafe. Where dual systems exist, each premises should have competent water supervisors who are responsible at all times for the laying and use of the various pipe lines and equipment, and for the avoidance of cross connections through which a dangerous supply may reach the drinking system.

ENFORCEMENT OF REGULATIONS

A utility should have the right to discontinue service for violation of the regulations against cross connections, backflow, backsiphonage, or for any other abuse of the use of the water. The consumer, however, is entitled to a reasonable notice of the intent of the utility to discontinue his service because of violation of applicable health laws or utility rules. He is also entitled to have a reasonable opportunity to comply, or cease the violation, provided that he is not creating conditions immediately dangerous to public health and welfare.

Rules and regulations properly developed and administered will embody a uniform practice for the installation of water-system facilities and for the various kinds of water service rendered by the utility. When the engineering, financial, and administrative factors are correlated into practicable, workable regulations, the obligation of the utility to its consumers, and of the consumers to the utility, will be defined. This allocation of responsibilities will go a long way toward solving the troublesome problems arising in the engineering administration of water utilities.



WATER-METER DISKS WARPED AND SPLIT BY HOT WATER FROM CONSUMER'S PREMISES

Consumers are Often Unaware of This Danger

Engineers' Notebook

Ingenious Suggestions and Practical Data Useful in the Solution of a Variety of Engineering Problems

Use of Nomograms in Solving Stream-Flow Routing Problems

By RAY K. LINSLEY, JR., JUN. M. AM. SOC. C.E.

ASSOCIATE HYDRAULIC ENGINEER, WEATHER BUREAU OFFICE, SACRAMENTO, CALIF.

STREAM-flow routing by use of the storage equation is an established part of the methodology of hydrology and hydraulics. Numerous solutions, both graphical and tabular, of the basic storage equation have been presented, many involving a rather tedious process requiring repeated reference to a curve or curves of a storage function. Considerable time is required for the operation. The writer has found that nomograms or alinement charts can often be developed for the solution of the storage equation in many of its forms. Some examples are cited here.

The following nomenclature will be used:

S = volume of storage
O = rate of outflow from reach (Subscripts 1 and 2 refer to the beginning and end of the routing period, respectively.)
I = rate of inflow to reach
T = length of routing period
$\bar{O}, \bar{I}$ = average rate of inflow and outflow during routing period

Perhaps the simplest assumption used in routing is that $S = f(O)$. The storage equation can then be written

$$\bar{I} - {}^1/_2 (O_1 + O_2) = S_2 - S_1 \quad \ldots\ldots (1)$$

or

$$\bar{I} + (S_1 - {}^1/_2 O_1) = (S_2 + {}^1/_2 O_2) \quad \ldots\ldots (2)$$

A nomogram, Fig. 1, was constructed for routing runoff from the Kern River Basin through valley storage by the use of Eq. 2. Scales actually used in the final nomogram are shown along with those used only to develop the nomogram; asterisks mark the latter. To use this nomogram, hold a straightedge between the value of O on Scale 1 and the runoff on Scale 3. Then read O_2 on Scale 2. In the preliminary steps, values of $(S_1 - {}^1/_2 O_1)$ on Scale 1 and values of $\bar{I}$ on Scale 3 are added to give the sum $(S_2 + {}^1/_2 O_2)$ on the central scale. Since $S = f(O)$, $S \pm {}^1/_2 O = f(O)$, and values of $S \pm {}^1/_2 O$ on Scales 1 and 2 can be replaced by values of O. In the routing process the storage relation is no longer needed, routing being accomplished with O and I alone.

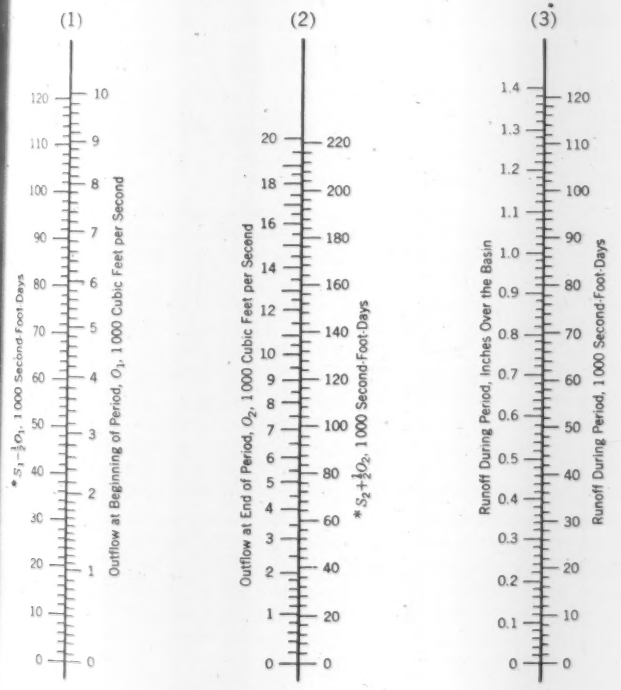

(1)
(2)
(3)
* $S_1 - \frac{1}{2}O_1$, 1 000 Second-Foot-Days
Outflow at Beginning of Period, O_1, 1 000 Cubic Feet per Second
Outflow at End of Period, O_2, 1 000 Cubic Feet per Second
* $S_2 + \frac{1}{2}O_2$, 1 000 Second-Foot-Days
Runoff During Period, Inches Over the Basin
Runoff During Period, 1 000 Second-Foot-Days

FIG. 1. ROUTING NOMOGRAM FOR THE KERN RIVER ABOVE BAKERSFIELD, CALIF.

(1)
(2)
(3)
$S_1 - \bar{O}$, 1 000 Quarter Second-Foot-Days
Average Outflow at Red Bluff During Period, 1 000 Cubic Feet per Second
Average Outflow at Red Bluff During Following Period, 1 000 Cubic Feet per Second
* S_2, 1 000 Quarter Second-Foot-Days
Reach Inflow During Period, 1 000 Quarter Second-Foot Days

FIG. 2. ROUTING NOMOGRAM FOR THE SACRAMENTO RIVER FROM SHASTA DAM TO RED BLUFF

The nomogram of Fig. 1 was developed for routing runoff through valley storage, and since runoff is often conveniently expressed in inches of depth over the basin, Scale 3 has alternative graduations in inches.

In the May 1941 issue of CIVIL ENGINEERING, Otto H. Meyer suggested the use of a relation in which storage is a function of outflow t hours later, where t is a lag that most effectively narrows the storage loop. If $T = 2t$, then $S_1 = f(O_{1/2T})$. Assuming $O_{1/2T} = \bar{O}$, the storage equa-

tion can be written $\bar{I} - \bar{O} = S_2 - S_1$ .....(3)

or $\bar{I} + (S_1 - \bar{O}) = S_2$ .....(4)

A nomogram for the solution of Eq. 4 is shown in Fig. 2. Values of $S_1 - \bar{O}$ are added to $\bar{I}$ to give values of S_2 on the central scale. Since $S = f(\bar{O})$, $S - \bar{O} = f(\bar{O})$, and values of $\bar{O}$ can replace values of $S_1 - \bar{O}$ and S_2. A straightedge held from a value of $\bar{O}$ for the first period to a value of $\bar{I}$ for the same period will intersect the proper value of $\bar{O}$ for the second period on the center scale. As in Fig. 1, the scales not actually needed on the final nomogram are marked with asterisks.

If storage is expressed as a straight-line function of $I + O$, or of weighted values of $I + O$, the nomograms, although more involved than the examples cited, offer a considerable saving in time and effort. In general, the more complex the routing procedure, the more complex the nomographic solution becomes, so that in some cases little saving will be effected. Often, however, simple nomograms can be developed for approximate solutions of some of the more complex routing schemes. Such nomograms may prove of value in expediting preliminary solutions.

Where the stage discharge relation is constant, values of stage may replace flow values on the inflow and outflow axes. This gives further simplification where stages are of primary interest. Other special variations in procedure will become apparent as each problem is considered. The use of the nomogram does not affect the accuracy of the routing since it is merely a graphical solution of established procedure, and can be quite as accurate as the tabular solution if proper scales are used.

Stability of a Cantilever Retaining Wall

By STANLEY U. BENSCOTER, JUN. AM. SOC. C.E.
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ONE step in the design of a cantilever retaining wall is the computation of base pressures. The stability of such a wall is regarded as satisfactory when the resultant of these pressures acts at the edge of the middle third of the base. This gives a pressure of zero at the heel. In a cohesionless soil, this represents an impossible state of stress at the heel. A realization of this fact requires and suggests a concept of "satisfactory stability" somewhat different from that now commonly accepted. Such a concept leads to the possibility of increased economy in the design of cantilever retaining walls.

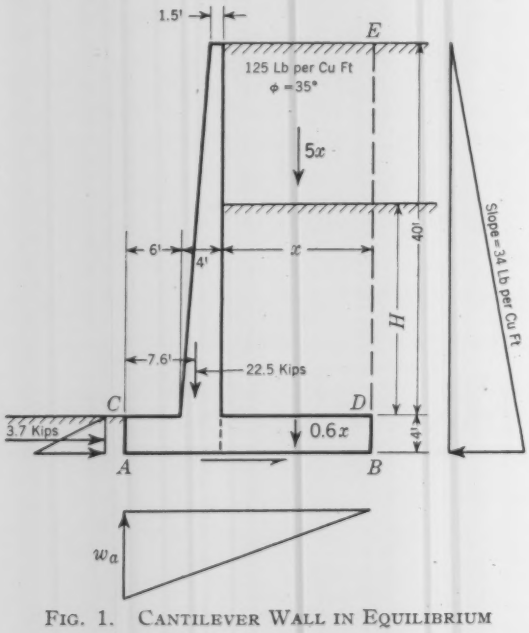


FIG. 1. CANTILEVER WALL IN EQUILIBRIUM

In the example shown in Fig. 1, the dimensions of the wall and soil characteristics have been chosen arbitrarily. The dimensions were not selected in any attempt to secure maximum economy, but for convenience. The length of the heel is not given, but is indicated as x. The equations of equilibrium, if applied to the wall, tell us that a choice of $x = 9.8$ ft will, theoretically, give a heel pressure of zero. (The force on the face AC is assumed to have the full passive strength of the soil.)

A cantilever wall designed by the customary procedure, surrounded by cohesionless soil, will develop a shearing force on plane EB. If the distance x in Fig. 1 were made 10.4 ft, the equations of equilibrium would show the heel pressure to be 0.41 kip per sq ft, or K^2wH, where K is Rankine's coefficient for active earth pressure. With this base width, no shearing force would be required on plane EB. If the distance x is made less than 10.4 ft, a shearing force must develop on plane EB, and the magnitude of this force will increase as x decreases. There is an apparent limit to this shearing force, given by

$$\text{Limit of } S = \frac{K}{2} wH^2 \tan \phi \quad \text{.....(1)}$$

where H is the distance from point B to the ground surface. Let us write the actual value of S required with any given base width to maintain the heel pressure at 0.41 kip per sq ft as,

$$S = \epsilon \left(\frac{K}{2} wH^2 \right) \tan \phi \quad \text{.....(2)}$$

The factor ϵ may vary between zero and one. The equations of equilibrium provide us with a relation between ϵ and x, which is shown in Fig. 2. The value $x =$

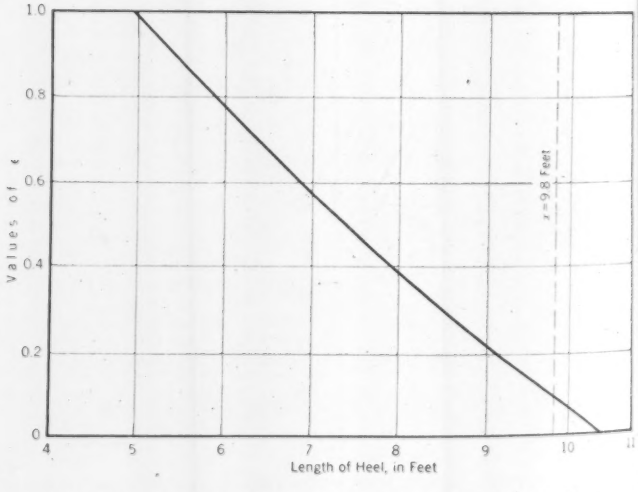


FIG. 2. CHART INDICATING REQUIRED LENGTH OF HEEL

0.8 ft, which would be obtained by customary procedure, corresponds to $\epsilon = 0.1$. This means that on plane EB a shearing force would develop equal to

$$S = 0.1\left(\frac{K}{2}wH^2\right)\tan\phi = 2.31 \text{ kips per ft} \quad \ldots\ldots (3)$$

It should now be apparent that the wall of Fig. 1 could be designed by the following procedure. Assume that a shearing force acts on plane EB, the magnitude of this force being given by Eq. 2. This requires a decision as to the correct value of ϵ to allow. As usual, such a decision must depend upon the results of experimental studies. Such studies should measure the rotation and resultant translation of walls designed for various values of ϵ. For the chosen value of ϵ, compute the distance x and the toe pressure w_a from the equations of equilibrium.

Let us now consider the wall in Fig. 1 designed for $\epsilon = 0.5$. From Fig. 2 we find $x = 7.4$ ft. Such a wall is shown in Fig. 3 (*a*). The heel pressure that would develop as the fill is placed is shown in Fig. 3 (*b*). When the fill reaches elevation h_1, the heel pressure becomes wy. When the fill reaches elevation h_2, the heel pressure becomes Kwy. And at h_3, the pressure becomes K^2wy. The reader will find it instructive to picture the representation of the state of stress at point B in a Mohr diagram for various elevations of fill. While the last 6 ft of fill are being placed, a shearing force must develop on plane EB. If advantage is taken of this force in cantilever wall design, an appreciable saving will result.

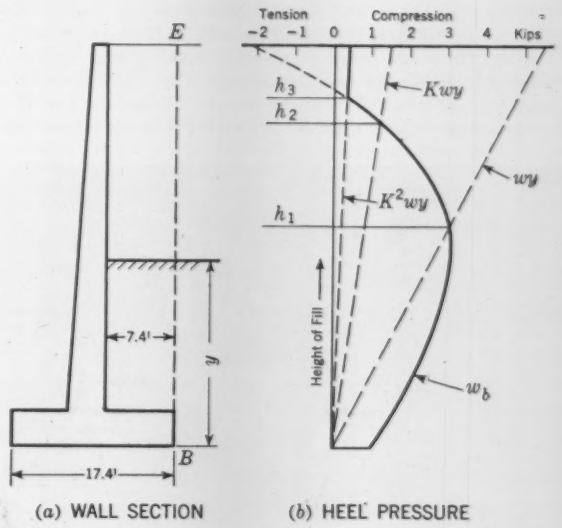


FIG. 3. WALL DESIGN TO ASSURE SHEARING FORCE ON PLANE *EB*

Our Readers Say—

In Comment on Papers, Society Affairs, and Related Professional Interests

Large Mining Project in New York State

TO THE EDITOR: In connection with my article, "Inclined Mine Shaft Sunk in the Adirondacks," in the April issue, it may be of interest to point out that a contract has been signed between the Republic Steel Corporation and the Stiefel Construction Corporation for all the mining of iron ore at the Fisher Hill Mine at Mineville, N.Y.

The Stiefel Construction Corporation has completed a 2,000-ft shaft and tunnels on six levels, 300 ft apart. The Fisher Hill Mine is designed to produce 2,500,000 tons of crude ore per year. It is the largest single iron ore mine in this country and, probably, the world. Many of the men employed on the recently completed Delaware Aqueduct are now engaged on this mining venture, and many more men will be employed. The mining work began April 1. In all the history of mining, this is the first contract of its kind.

The work to be performed is development work, haulage ways, drifts, raises, sub-levels, overbreaks, and all mining of ore. This includes installation of haulage tracks, a 6-in. air line, a 4-in. water line, power lines, installation of scraper platform, scraper hoists, and ventilation equipment. Drifts are 9 ft high and 12 ft wide; raises 6 ft by 8 ft. Payment is made per ton of crude ore weighed on conveyor scales at the crushing plant and on railroad cars at the mine. The drift work, raises, sub-levels are paid per linear foot; overbreaks at scraper stations per lump sum.

In the total value of mineral products, New York State ranks ahead of Alabama, Arizona, Colorado, Idaho, Missouri, Montana, Nevada, and South Dakota. It produces, in addition to the best grade of iron ore and pig iron, ferro alloys, titanium, aluminum, cement, clay products, coke, garnet, graphite, gypsum, lead, zinc, petroleum, natural gas, salt, talc, and several other ores and mineral products.

FRED W. STIEFEL, Assoc. M. Am. Soc. C.E.
President, Stiefel Construction Corporation
New York, N.Y.

Pioneer Survey Parties in Latin-America

DEAR SIR: In CIVIL ENGINEERING for November, Major Spickard has given an interesting account of the Pan-American Highway as constructed under his direction, treating the work as an adventure in pioneering. If the term "pioneering" suggests a previously unexplored country where the workers are dependent on their own resources, a very incorrect picture may be given the uninformed reader. If one considers the travels of the original inhabitants before the voyages of Columbus, or the journeys of the Spanish conquerors who settled Central America very thoroughly in the three centuries following the discovery of America, or the great amount of wheeled travel over Central American roads since the beginning of the nineteenth century, one can hardly regard as "pioneering" the surveying and building of a highway in that region at the present time.

About 1892 an inter-continental railroad survey was made along the Pacific coast from Mexico to Panama, and thence through Colombia, Ecuador, and Peru. The field parties had to make their camps and run their lines through all the territory traversed by the present pioneers without benefit of airplanes, radio, electric lights, refrigerators, or "jeeps." Along the line of this survey there was constructed the part of the International Railways of Central America that is near the Pacific coast of Guatemala. The Pacific Railroad of Nicaragua, between Corinto and the lakes, also followed this line.

It is of interest that the illustration showing the "dense Panama jungle" displays a great likeness to wooded hillside country elsewhere, and is indistinguishable from views of similar road work in, say, Paraguay or North Carolina. The surveyors of the projected Nicaragua Canal route, who ran their lines before the decision in favor of a route through Panama, used to regard such hill country as the choice part of the line. There the camps were well drained and the survey party escaped the hardships of their companions in the swamp regions, who had to struggle through mud and water in the dense flat jungle of mixed palm and hardwood trees and

tangled vines. In the swamp country progress was limited by the work of laborers with machete and ax, and seldom exceeded half a mile a day. Rain fell every day, and clothing was always wet. Dry attire was available only on Sundays in a camp on a river bank clearing, a few feet above high water. In one section the mud was too soft for an instrument set up with the usual tripods, and it

"JUNGLE" ROAD IN PARAGUAY—JANUARY 1941
This Road Is in Normally Wooded Hill Country

was necessary to extend the legs by lashing them to poles. When even this expedient failed, tree stumps were cut a foot or two above the swamp and the instrument head was set and leveled on these while the surveyor stood behind with only his head and shoulders out of water.

Contrasted with living conditions as the writer recalls them, the "hardships" mentioned by Major Spickard present a picture of luxury. We used to live for long periods on "food bought from the natives," preferring it to the monotony of canned goods. We had no previous tropical experience and no Spanish but rapidly acquired both. We made the same complaints about rice and beans as our predecessors and successors and composed the same kind of tropical ballads. There were no excuses for leaky shelters. Repair material in the shape of thatching of various kinds of broad leaf trees was obtainable with a machete. The eating of monkey meat seemed too close to cannibalism. The meat of the wild hog or peccary and other denizens of the forest was more to the native taste. Edible roots, such as yucca or mandioca and yam, are a staple diet throughout the Americas.

It is not clear to the writer why the Army surveyors were unable to procure the necessary instruments for use with the metric system, which is usual in Central America. The same transit or level can be employed whatever unit is adopted, and the writer has had no difficulty in securing tapes and rods with metric graduation on the various occasions when he has been equipping parties for work in Latin America. In fact, some of the equipment mentioned as

FINISHED SECTION OF THE INTER-AMERICAN HIGHWAY NEAR PANAMA CITY—1906
This Road—to Old Panama Ruins—Is Now Paved with Concrete

having been used by the Nicaragua Highway Department may have been left there by the writer at the termination of the Managua contract in 1930.

HENRY WELLES DURHAM, M. Am. Soc. C.E.
New York, N.Y.

Construction of Composite T-Beam Bridges in Australia

DEAR SIR: The article on "Welding to Ensure Composite Beam Action" by Glenn L. Enke, in the January issue, was of particular interest to Australian readers, as in the past twelve years the construction of composite T-beam bridges has become fairly common practice here. This practice has established the improved economy and stiffness of this type of bridge.

By using temporary props under the beams while dead load is placed, the composite sections can be made to carry dead load as well as live load. Prestressing the steel beams by a jacking system before the dead load is placed has been used to give a better stress distribution in the steel portion of the composite section.

Composite T-beam construction has also been used for railway bridges. The proportion of live to dead load is so large in short-span railway bridges that propping to utilize the composite section for dead load as well as live load is not worth while.

A more elaborate arrangement than that described by Mr. Enke is used in Australia to resist shear stresses between the steel beam and the concrete slab. Square steel bars are welded to the top flange of the beam and bent up into the concrete slab. A hook at the upper end ensures good anchorage in the concrete. A concrete haunch between the steel beams and the deck slab is generally adopted to increase strength and stiffness.

The development of this type of bridge in Australia is undoubtedly due to the general use of electrical welding for bridge construction in this country.

A. W. KNIGHT, Assoc. M. Am. Soc. C.E.
Chief Engineer, Tasmania Department of Public Works
Hobart, Australia

Bridges for Limited Period of Service

DEAR SIR: I was interested in the ideas expressed in Raymond Archibald's letter to the editor on the durability of bridges and other structures, which appeared in the April issue. He has suggested an objective which is worthy of consideration but which may be difficult to accomplish—namely, that we build our structures to serve only to the extent that we can reasonably predict our future needs, say for a period of twenty years.

With particular reference to bridges, it would appear that any structure so constructed as to be sound and adequate for twenty years would inherently be durable enough to last more than twice that long even though it might not be adequate for traffic. In determining the size of a stream crossing, one could not justify a design based on a 20-year flood when it is very likely that a 100-year flood might occur during the assumed 20-year service of the bridge and destroy it. It seems unlikely that we will ever be able to build a structure that will be adequate and sound for a limited number of years and then suddenly, like the "one-hoss shay," become entirely inadequate.

JOHN W. COURTER, Assoc. M. AM. Soc. C.E.
Austin, Tex.

Analysis of Stepped Crane Columns

TO THE EDITOR: I would like to call attention to an error that appeared in my article, "Stepped Crane Columns Analyzed by Diagram," in the February issue. The first sentence of the last paragraph should read, "It should be noted that Figs. (4*b*) [instead of 4(*a*), as stated] and 5 can be used for bents with any degree of fixity of the column base by using the expression $M_A FC_A wL^2, \ldots$"

M. SCHLESINGER, Jun. Am. Soc. C.E.
Chicago, Ill.

Forum on Professional Relations

CONDUCTED COLUMN OF HYPOTHETICAL QUESTIONS WITH ANSWERS BY DR. MEAD

The writer has been absent from his office much of the time for the last two months and on this account inadvertently duplicated Question No. 19 and sent it as Question 20. For this reason he will not further discuss that question, but will use the space to discuss a letter from Frederick W. Newton, Assoc. M. Am. Soc. C.E., of New York City.

The letter reads as follows: "I wish to express disagreement with the reasoning but not with the conclusion contained in the answer to Question No. 14, published on page 590 of CIVIL ENGINEERING for December 1943.

"The answer shows the anomalous position that engineers occupy, largely of their own creation. An engineer is the employee of one party, but assumes the duties of an arbiter between the parties. He is, of course, the representative of the party by whom he is employed, and to be a true arbiter of the contract and specifications, he must have qualities which are somewhat more than human.

"The engineer should be recognized as the agent of the owner. It is proper to say that as such agent he should not accept employment by the contractor. But to say that he should not accept such employment because, if he does, he cannot 'assure perfect equity to both parties' ignores one of the strongest loyalties of human nature—the loyalty to the one who furnishes his bread and butter.

"The engineering profession should abandon the fiction that an engineer is arbiter between owner and contractor, and should recognize the fact that the engineer is employed by and is the agent of the owner. When it is said that work is to be done to the satisfaction of the engineer, it means that the work is to be done to the satisfaction of the owner. If the owner or engineer is unreasonable in his demands or in his interpretation of the contract, the contractor's rights should not be prejudiced by the unwarranted assumption that the engineer is or can be a disinterested arbiter."

In answer to the foregoing letter by Mr. Newton, the writer would like to say that his answer to Question No. 14 was intended to call attention to the difficulties of serving two clients with adverse interests. Mr. Newton's statement emphasizes the difficulty that engineers have of being fair with all with whom they come in contact, and the universal human tendency to act unfairly in favor of one's clients. It is quite generally recognized that in supervising any engineering work, either public or private, the engineer has no rights or privileges except those specifically given him by the contract, but it is usually provided that he shall be arbiter between his client and the contractor. In such cases, all the engineer's decisions must be in accord with the contract and specifications or they will not be upheld in court. It is true that a contractor will often do work beyond the requirements of the specifications rather than take the matter into court; and an unfair engineer frequently can cause the contractor unfair and unnecessary expense by unjust requirements. Indeed, fifty years ago it was not uncommon for engineers to brag about causing contractors so much extra expense that they made no profit on the work they had undertaken, and at times even failed in business on account of unjust demands. Of course, such action on the part of an engineer is disgraceful, and the writer believes that, at the present time, it is also uncommon.

The writer agrees largely with Mr. Newton's statements and believes that they would agree perfectly if they were to discuss the question in person. He believes, with Mr. Newton, that all engineers are prejudiced in favor of their clients and, in border-line cases where there is a valid reason for a difference in opinion, will almost always decide a point in favor of his client. He believes, also, that when the client makes unjust demands that are clearly not in accord with the terms of the specification, every engineer of fair experience and good standing would not hesitate to say so in no uncertain language. If in the construction of a street, for example, the specifications should provide for a 6-in. concrete foundation and the client should decide that he wanted it 7 in., no experienced engineer would fail to inform his client that such change could not be made under the contract without a payment for extra work and material.

All contractors realize that the engineer-arbiter is employed by the client and will be more or less biased by that fact. In many cases contractors require that the name of the engineer be specified in the contract. In some cases contractors will refuse to bid or to sign a contract if the engineer for the client is known to be very unfair and to make very unjust decisions. On the other hand, no engineer who is known to be reasonably fair to all concerned ever has any difficulty in finding contractors who are willing to accept him as arbiter on these contracts and to take the risk of his decisions.

The writer believes that the prices bid are often modified by the personality of the engineer as well as by the specifications, and that when an arbitrary or unfair engineer attempts to let a contract, his client has to pay for his unsatisfactory reputation.

In the matter of contracts, the writer does not see but what the engineer must continue to be the arbiter as no other engineer called in on the job would have sufficient knowledge of the conditions to render satisfactory decisions except with much delay and unnecessary expense.

The writer believes that the engineer should recognize his tendency to have a biased judgment and that he should endeavor to overcome this tendency and be just to all. In much of the engineer's work this is most important. Frequently engineers are asked to report on various public works on which bonds are to be issued and sold to the public. To be a safe investment to all concerned, such public works must first have an earning capacity which will give to the company:

1. A return on the bonds issued equal to the interest on the same.
2. A return on the stock equal to the cost actually invested, if any, at the ordinary commercial rate.
3. A return equal to the operating expenses plus the cost of depreciation.
4. A fair profit above the total costs enumerated in the foregoing, which will make the investment attractive.

If all these items are beyond reasonable question, it will warrant (1) the original investment and the purchase of bonds for such a bond house, (2) the purchase of the bonds by individuals as an investment, and (3) the purchase of the original stock. Unless all who invest in this enterprise are safe, none are safe. The interests of all must be carefully considered, and unless they can be so considered a report should be made against the investment. The report must therefore give all factors both favorable and unfavorable to the success of the project.

Such reports are commonly made in the interest of the bond company, which will distribute such bonds to its investor clients. Sometimes a company wishes to know all the facts in the case for its own protection but, while desiring all adverse information for its own protection, would like to have such facts omitted from the report to be used in connection with the sale of the bonds to its clients. No engineer who desires to continue his work in this field can afford to furnish any report but one including all the facts, for a single failure of a project on which he has issued a favorable report will show his entire unfitness for this line of work. Breadth of knowledge, honesty of purpose, and fairness to all are, therefore, absolutely essential for such work. Most engineers who are successful in this type of work and similar fields recognize that dependability is essential to their continued success and have learned to cut personal bias to a minimum.

The writer therefore believes that successful engineers have learned largely to eliminate personal bias in the supervision of contracts as well as in the making of worth-while reports.

DANIEL W. MEAD, Past-President and Hon. M. Am. Soc. C.E.

Madison, Wis.

Question No. 21, as given in the April number, will be answered in the next, or June, issue. Meanwhile, further discussions by members may be submitted. Next in the series the following—sent Dr. Mead by a correspondent—is announced. Replies may be received until June 5, with answers in the July issue.

QUESTION NO. 22: *A junior engineer not yet middle aged has, as a result of some years of unsuccessful practice, been obliged to accept a position as draftsman in a large engineering firm and at a loss in salary. He has been promised advancement, but finds that invariably those who receive such advancement are agreeable fellows, whereas his temperament is such that he is kept in the position of draftsman at a salary hardly sufficient to meet the expenses of a growing family. How can he overcome this condition, which is discouraging and embittering him?*

SOCIETY AFFAIRS

Official and Semi-Official

Supplementary Recommendations Issued by Committee on Employment Conditions

Ordered Printed by Board of Direction's Executive Committee

Recent experiences and legal advice as to details have caused the Society's Committee on Employment Conditions to suggest interpretations of the Board's action relative to collective bargaining by professional engineering employees. These suggestions took the form of a letter, with three supplements, addressed by the Secretary of the Society to the Presidents and Secretaries of all Local Sections under date of March 21, 1944.

Letter of Transmittal

March 21, 1944

To the Presidents and Secretaries
of the Local Sections of the
American Society of Civil Engineers

Gentlemen:

The Society's Committee on Employment Conditions has directed that there be issued from time to time, suggestions relating to the local Committees on Employment Conditions which the Board of Direction of the Society recommended be instituted in each Local Section by amendment of the Section's Constitution.

On November 23 last, you were informed regarding Society procedure in the matter of amending a Local Section constitution. At this time the following twenty-two Local Sections have voted by letter ballot to amend their constitutions, the texts of which have been accorded approval by the Board of Direction acting through a special committee appointed to administer this detail.

Central Ohio Section
District of Columbia Section
Florida Section
Georgia Section
Kansas Section
Kansas City Section
Lehigh Valley Section
Los Angeles Section
Louisiana Section
Maryland Section
Miami Section
Mid-Missouri Section
New Mexico Section
Oklahoma Section
Oregon Section
Pittsburgh Section
San Diego Section
Seattle Section
Tacoma Section
Tennessee Valley Section
Virginia Section
West Virginia Section

In the Cincinnati, Northeastern, and Sacramento Sections the amendment is reported to have failed of adoption.

For the benefit of those Local Sections which have not acted as yet, it is now repeated that when an amendment is voted upon, the following data should be reported to Headquarters in order that the Board of Direction's approval may be accorded:

1. Text of the amendment.
2. Date of canvass of the amendment.
3. Number of members of the Society allocated to the Section.
4. Number of subscribing members in the Section.
5. Number of subscribing members voting in the affirmative.
6. Number of subscribing members voting in the negative.

[EDITOR'S NOTE: *As of April 21, the following corrections may be made: Alabama, San Francisco, and Sacramento Sections have voted to amend their constitutions, the latter having taken a second vote.*]

INTERPRETATIONS OF THE PROPOSED AMENDMENT

The Society's Committee on Employment Conditions now believes it necessary to suggest some interpretations of the intent and phrasing of the amendment as proposed, or as it may be phrased for adoption.

This letter, with its supplements, has been spread, by direction of the Executive Committee of the Society. The June and subsequent issues of this publication will be open for comments by members of the Society. Such comments as may be submitted should be confined to not over 600 words and should be available for publication not later than the fifteenth of the month to appear in the following issue of "Civil Engineering."

It is deemed well that "Professional Engineering Employees" should group themselves for the protection of their professional status and do so in preparation for collective bargaining as provided for by Federal and State laws.

It is deemed well that this should be done by such engineers engaged in the field of civil engineering and that the Society's Local Section areas constitute appropriate geographical areas in which the proposal should be subjected to local determination by civil engineers and without the implication that professional engineering employees in other branches of the profession are under any kind of direct solicitation to conform.

While employers may not participate in collective bargaining by employees it is deemed well that, as members of a Local Section, they should have a vote in deciding whether or not the proposal shall be entered upon in any given area.

Collective bargaining "Units" can be instituted anywhere with respect to any specific employer. However, it is deemed well that those "Units" that have as their objective the preservation of the economic status of professional engineering employees should operate in a professional, ethical and wholesome manner in all ways and that therefore the members of such "Units appropriate for the purpose of collective bargaining" (the legal term) should be composed of only those who have been accredited by their fellows as members of a professionally minded homogeneous group.

The proposed amendment as drafted was pronounced appropriate by legal counsel. Clarification, as a result of subsequent experiences and legal advice as to details, would permit that the amendment be viewed as a framework, such as an enabling act, within which to operate. The committee therefore proposes the following interpretations:

(*a*) That the effect of the amendments be to establish "Groups" of "Professional Engineering Employees" resident, or employed, in the respective areas, although employees of different employers, to act as a body of men sympathetic to the preservation of their professional status through collective bargaining procedures by "Units" constituting a majority of those professional engineering employees employed by any specific employer. Distinction is here made between a "Group" and a "Unit," the latter being recognized as a legal term, properly to be identified under the auspices of the National Labor Relations Board, and the former being recognized as not more than a voluntary association of men of a type, united by their own Rules and Regulations.

(*b*) That in support of this group atmosphere the effect of the amendment be to separate the institution, and continuance, of the group from the Local Section's Board of Directors, and the Section's Secretary, by the delegation of all functions assigned to them by the terms of the amendment to an "Interim Committee on Employment Conditions" composed of members of the Society generally recognized as employees; leaving the institution and functioning of the group thereafter to them and the members of the group.

(*c*) That the local Committee on Employment Conditions be understood to be the administrative body of the group. Although

the amendment may provide that that committee shall "represent" the group members, it is to be understood that "a unit appropriate for the purpose of collective bargaining" may, by vote, select some other persons, or person, to be its "exclusive bargaining agent."

(*d*) That the dues specified be understood to be those needful for the operation of the group except as, by decision of the Committee on Employment Conditions, contributions from the funds of the group may be made towards the operations of a "Unit."

The Committee does not deem it necessary that the amendment, as proposed, be re-amended although it now appears advisable to indicate that an important modification must be made of the original indication that what is herein called a "Group" can function as a "Unit appropriate for the purpose of collective bargaining." The present indication is that the "Group" can be no more than an assemblage of persons of a type, as defined, which can facilitate the formation, and exert a wholesome influence upon, appropriate "Units," preferably to be made up of members of the "Group."

The Committee, also, deems the procedures relative to elections, public meetings, public accounting, etc., set forth in the proposed amendment to apply with equal force to the operations of the "Group," as stipulated by the amendment to apply to the Officers of the Section.

The Committee advises that the Local Section's groups do not use the name "American Society of Civil Engineers," because it is not intended that membership in the groups (or units) shall be limited to members of the Society.

It was to forestall the need for frequent or aggressive action that the Board recommended that a local Committee on Employment Conditions be delegated to act for the group under its general direction. The group forms a background, permissible under the law, from which the Committee on Employment Conditions, as the agency of the group, derives its authority to enter into negotiations, or conciliatory action, and to make agreements with an employer in behalf of the members of the group in the event of a dispute, or the need for rectification of conditions of employment when situations do not come to the point that a "unit appropriate for the purpose of collective bargaining" must be brought into existence. In such case the Committee on Employment Conditions may not act as that "Unit's" "agent" unless so designated by the vote of that unit.

When a Local Section has amended its constitution and the Board of Direction has expressed its approval of the text of the amendment, the group may be instituted.

Attached are recommendations proffered by the Committee on Employment Conditions:

(1) "Institution of a local 'Group of Professional Engineering Employees'"
(2) "Rules and Regulations for a 'Group of Professional Engineering Employees'"
(3) Sample "Application Form"

Further suggestions will be forwarded from Society Headquarters from time to time and questions sent by mail or wire will be answered as promptly as practicable.

Very truly yours,
(*Signed*) GEORGE T. SEABURY, *Secretary*

Approved by the Committee
March 19, 1944

Institution of a Local "Group of Professional Engineering Employees"

1. It is recommended that the Section's Board of Directors delegate to an "Interim Committee on Employment Conditions," composed of members of the Section generally recognized as employees, all functions accorded the Board of Directors or the Secretary of the Section by the amendment, for it to administer until such time as the members of the group shall meet to elect the more permanent Committee on Employment Conditions from among its members. It is also recommended that this "Interim Committee on Employment Conditions" have as one of its functions the task of assembling the original roster of the "Group."

2. When the amendment, as adopted, makes no definite provision for the determination of who may properly constitute the local Committee on Employment Conditions, or the original group, or who may collect the dues from those who are to constitute the original group, it is suggested that the Section's Board of Directors delegate to the interim committee the performance of these functions.

3. Membership on such an interim committee should continue until the initial group shall assemble to elect the more permanent Committee on Employment Conditions. Membership on such an interim committee should in no way prejudice election to the more permanent committee.

4. The Interim Committee on Employment Conditions should assemble a roster of those who are eligible for membership in the "Group of professional engineering employees," as indicated by the definition approved by the Board of Direction of the Society. First the applicants should be those who are members of the Society allocated to, or employed within, the Section area and, later, those who are non-members of the Society resident, or employed, within the Section's area who express their desire to join the group.

5. Applications, accompanied by the group dues provided by the amendment, should be forwarded to the interim committee. The local expense of this procedure should be defrayed from the group dues collected. A sample Application Form is enclosed.

6. The interim committee should call a meeting and assemble the members of the Section whom it has identified as properly to belong to the group, one member of the interim committee to act as Chairman and another to act as Secretary; these officers to be elected by the interim committee.

7. Those accredited members of the group present should proceed:

(*A*) To adopt a name for the group, preferably to be similar throughout the United States. The following are suggested: "The Oregon Group of Professional Engineering Employees" or "The Lehigh Valley Group of Professional Engineering Employees."

(*B*) To elect a Committee on Employment Conditions from among its members in accordance with the terms of the amendment, the members of this Committee to serve with full effect until the time of the Annual Meeting of the Group as provided in the amendment and without prejudice to their initial election as permanent members of that committee at that subsequent Annual Meeting.

(*C*) To authorize the Committee on Employment Conditions

1. To accept from the Secretary of the Local Section, or from the Interim Committee on Employment Conditions, the group dues received prior to the election of the Committee on Employment Conditions, less previous organizational expenses accounted for.
2. To open a bank account.
3. To bond its members.
4. To purchase books of account and enter therein all receipts and disbursements.
5. To make such other disbursements as it may deem necessary.
6. To keep minutes of its own meetings and meetings of the Group and maintain a current statement of the financial condition of the Group.
7. To solicit and accredit additional civil engineer members of the Group; when engineers in other branches of the profession wish to join, to permit these persons to do so. Also, when in an individual project, plant, department, or employer's staff engineers in other branches of the profession, express the wish to join to complete the professional unit in that project, plant, department, or employer's staff, to permit them to do so.
8. To function, in general, in conformity with the letter and spirit of the amendment and the general direction of the Group and to act as the administrative body of the G oup.

(*D*) To adopt "Rules and Regulations" for the operation of the "Group." [*Note: Recommended "Rules and Regulations" are attached.*]

Suggested Rules and Regulations

THE (*State or Section Name*) GROUP OF PROFESSIONAL ENGINEERING EMPLOYEES

ARTICLE I PURPOSES

The purposes of this "Group of Professional Engineering Employees" are to improve, protect and maintain the employment conditions of the members of this Group in fair and reasonable relationships between them and their employers.

To effect these purposes this group is declared hereby to be ready to form and assist appropriate bargaining units composed exclusively of "Professional Engineering Employees" residing, or employed, within the limits of the (name) Section, of the American Society of Civil Engineers and members of this group, to assume the rights and privileges to be accorded them as sole bargaining units under agents of their own choosing; for the purpose of entering upon all appropriate collective bargaining procedures related to their compensation, hours and working conditions.

ARTICLE II QUALIFICATIONS FOR MEMBERSHIP IN THIS GROUP

Membership in this group shall be confined to those "Professional Engineering Employees" residing, or employed, within the limits of the (name) Section of the American Society of Civil Engineers. The definition "Professional Engineering Employees" is as follows:

"The designation 'Professional Engineering Employees,' used in the sense that persons capable of being so designated may join with others similarly capable of being so designated for the purposes of collective bargaining separately from any other group composed of persons not capable of being so designated, shall be that of only those who, excepting employers or those to whom employers have delegated managerial responsibility with respect to employment conditions, possessing an intimate knowledge of mathematics and the physical sciences, gained by technological and scientific education, training and experience, and in a position of trust and responsibility, apply their knowledge in controlling and converting forces and materials to use in structures, machines, and products, and whose work requires the exercise of discretion and judgment, is creative and original and of such character that the output cannot be standardized; and those who, without the experience set forth, but having been graduated from an approved educational institution and having received the degree of Bachelor of Science or its equivalent, in Engineering, are engaged in engineering work."

ARTICLE III EVIDENCE AND CONDITIONS OF MEMBERSHIP

(1) The "Committee on Employment Conditions" elected from the members of this Group shall review each application for membership in this Group and determine whether or not the applicant is a "Professional Engineering Employee" in accordance with the above definition.

(2) An applicant for admission to this Group must submit in writing to the Committee on Employment Conditions his education and experience record in sufficient detail to allow that Committee to pass judgment on the applicant's qualifications for membership in this Group. The applicant must state in writing that it is his desire to have membership in this Group, and that he has a community of interest with the other members of this Group.

(3) Upon approval of his qualifications by the Committee on Employment Conditions and the payment of the dues stipulated herein, a "Professional Engineering Employee" shall be considered a member of this Group.

(4) Any member who shall become unemployed shall continue to be a member of this Group so long as he pays his dues as provided for membership in this Group. Unemployed "Professional Engineering Employees" who are eligible for membership may be accepted to membership in accordance with these Rules and Regulations.

(5) With the consent of the Committee on Employment Conditions, previously obtained, a member of this Group may be a member of another bargaining group.

(6) A member in good standing shall be one who is not in arrears of dues. A member whose dues are not paid within 60 days after the Annual Meeting shall automatically lose his membership and shall lose the privileges of nominating, making or seconding motions or voting and he shall not hold office nor participate in meetings of the Group.

(7) No person shall be forced to be a member of this Group against his will.

(8) Members may be suspended or expelled for willful violation of these Rules and Regulations or for refusing to pay dues or for acting in any manner or engaging in any practice which will tend to bring discredit on the honor or dignity of the Engineering Profession.

(9) Any member of this Group who changes his residence, or place of employment, to the area of any other Local Section of the American Society of Civil Engineers wherein there is a similar Group of Professional Engineering Employees, shall be a member thereof upon the payment of any difference in dues and acceptance by the Committee on Employment Conditions of that Group.

(10) Each member of this Group shall authorize the Committee on Employment Conditions to represent him in all conciliations or negotiations short of active collective bargaining procedures. However, this shall not restrain any member of this Group from negotiating with his employee in relation to his own compensation, hours or conditions of employment.

(11) The Committee on Employment Conditions shall administer its functions in accordance with the general directions of the members of this Group to the end that this Group shall be self-administered, under leaders of its own choosing, and self-financed.

Sample Application Form

(*Obverse*)

I, ... apply for membership in
(Name, Printed)
the .....
I submit herewith (see reverse) my professional record as an engineer and state that I am not an employer, nor have I had delegated to me by my employer managerial responsibility with respect to employment conditions, to the extent of hiring and firing employees.
I am an employee of .....
Employer's Address .....
My present title is .....
My duties consist of .....
I am at present a member of .....
(Bargaining Group)
I hereby subscribe to the provisions of Article (—) of the Constitution of the ..... Section of the American Society of Civil Engineers.
I enclose the dues of .....dollars ($—) for 1944.

....
(Date) (Signature)

(over)

(*Reverse*)

I have been a profesional engineering employee for .....years.
(Please Print)
I am Resident at .....
Technological Background
If non-collegiate .....
(High, Night or Correspondence School—Home Study)
If collegiate .....
(School) (Years) (Degree)
I have had experience in activities requiring creative and original engineering judgment and discretion in the following positions.

....
(Dates)
....
(Dates)
....
(Continue on Supplemental Sheet if Necessary) (Dates)
I have a community of interest with the professional group and I consider myself a "Professional Engineering Employee" as defined by the Board of Direction of the American Society of Civil Engineers.
I authorize the Committee on Employment Conditions to represent me in all Group negotiations and I authorize the duly designated Unit Agent to represent me in collective bargaining procedures.
Date approved ....
(Qualifying Committee)

(over)

Recommended Card Size: 6 x 3¼

ARTICLE IV POLICIES AND PROCEDURES

(1) It shall be the established policy of this Group and of its Committee on Employment Conditions to maintain the same type of dignity and conduct that has been maintained by the American Society of Civil Engineers since its inception. It shall be its intent to recognize the spirit and the intent of all contractual relations developed.

(2) No agreement will be entered into which involves strikes, boycott, check-off or closed shop, nor shall this Group attempt to exercise any control over what employee shall be employed in preference to another employee, nor shall it attempt to dictate the number of employees to be engaged, nor pass upon the competency of an employee to perform the work assigned to him.

(3) The Committee on Employment Conditions shall consist, for the years 1944, 1945, and 1946, of three members of the (name) Section, each to be elected for a term of three years, except at the start; one member to retire each year. The committee shall elect from its membership a Chairman, a Vice-Chairman and a Secretary-Treasurer, each of whose terms of office shall be for one year, and each of whom may be reelected so long as he remains a member of the committee. Each member of the committee may succeed himself for one consecutive term of three years. All members of the committee shall be "Professional Engineering Employees" within the meaning of that term as defined previously herein.

(4) The members of the Committee shall be elected annually by letter ballot from the members of this Group who have paid the dues stipulated for them in Section (—) of Article (—) of the Constitution of the (name) Section of the American Society of Civil Engineers. Vacancies in the committee's membership shall be filled by letter ballot as occasion may require. The names of candidates for election to the committee, at either the regular time for election or to fill a vacancy, shall be placed on the ballot for election, by nomination from the floor at the time of this Group's annual meeting or upon the written request, previously received by the Secretary-Treasurer of the Committee on Employment Conditions of this Group, from ten members of this Group who are non-members of the (name) Section. Canvass of ballots and declaration of election shall be made by the Committee on Employment Conditions not less than ten days after date of issue of the ballot. Following the year 1946, members of the Committee on Employment Conditions may be of those non-members of the (name) Section who are members of this group.

(5) The Committee shall hold meetings at such times and places as are necessary for the transaction of its business. It shall keep a record of all its proceedings. It shall hold an annual meeting open to all of the members of this Group at the time and place of the annual meeting of the (name) Section for the purpose of presenting and filing reports, including a public report of its receipts and expenditures and their sources and purposes, and for the transaction of such other business as properly may come before it or the membership of this Group. Other meetings of this Group may be called, after due notice to all members, by the Chairman of the Committee on Employment Conditions, or upon the petition of ten members of this Group. All meetings of the Committee or of this Group shall be presided over by the Chairman of the Committee.

(6) When the Committee shall act in conciliation or negotiation with respect to any certain employer, any member of the Committee who shall have a direct interest in the outcome of the bargaining may withdraw from participation in that procedure and in such instance the Committee shall select and designate another Professional Engineering Employee to act as his alternate in that procedure.

(7) The expenses of the Committee shall be defrayed by dues of $— per year collected by the Secretary-Treasurer of the Committee from those members of this Group who are members of the (name) Section and by dues of $— per year similarly collected from those who are non-members of that Section, resident, or employed, within the Section's area.

(8) All members of the Committee on Employment Conditions shall deliver to their respective successors all property in their possession belonging to this Group. All of the funds and property of this Group shall be deemed to be held in trust for the benefit of the members of this Group.

(9) The dues of members shall be those stated in Article (—), Section (—) of the Constitution of the (name) Section, except that as emergencies may require they may be fixed, after due notice has been given to all members of this Group, only by affirmative vote of not less than two-thirds of the members of this Group in good standing voting, provided the total number of voters shall be not less than a majority of the members of this Group.

(10) Neither this Group, nor its Committee on Employment Conditions, shall incur any financial obligation chargeable to the (name) Section or to the American Society of Civil Engineers.

ARTICLE V AMENDMENT

(1) These Rules and Regulations may be amended, after due notice has been given to all members of this Group, only by affirmative vote of not less than two-thirds of the members of this Group in good standing voting, provided the total number of voters shall be not less than a majority of the members of this Group.

(2) No amendment shall be effective which would have the effect (*a*) of affiliating this Group with any other group composed of other than "Professional Engineering Employees" as defined herein, or (*b*) of diminishing the purposes of this Group to maintain fair and reasonable relations between its members and their employers, or (*c*) of violating such contractual relations as may be developed between this Group and employers, or (*d*) of incurring any financial obligation chargeable to the (name) Section or to the American Society of Civil Engineers, or (*e*) of bringing discredit on the honor or dignity of the Engineering Profession.

Adopted (date) at (place) (State)

(*Signed*)————SECRETARY-TREASURER
Committee on Employment Conditions

Extension of Society Activities for Postwar Construction

FOR almost a year the Society's Committee on Postwar Construction has been intensively promoting the idea of preparing at once for actual construction immediately following the war. An important forward step has now been taken in expanding this work.

A full-time office has been set up in New York City. The new office will be the headquarters of the Research and Development Division of the Committee.

Specifically, its purpose is to stimulate and assist local private interests and government units in expediting completion of engineering and architectural plans looking toward postwar employment in the construction industry. In charge of its new work, Vincent B. Smith has been appointed as executive director, and Mark B. Owen as director. Both are members of the Society.

VINCENT B. SMITH

Activities of this unit will be directed from its office in Room 1421, 330 West 42d Street, New York, N.Y. The location will be particularly convenient inasmuch as the staff can thus use the reporting facilities of the McGraw-Hill Publishing Company, which will supply its project reports on the progress of postwar construction.

The research staff will compile and issue comprehensive inventories for the guidance of public officials, industrialists, engineers, and architects. These inventories will provide accurate information relating to the volume of private and public postwar construction planning in progress or completed in various sections of the nation, classified as to types of projects. Reports also will be

made available to newspapers and to all technical and business publications interested in such data, as well as to public and civic organizations and to the Local Sections of the Society.

Further, the program is to be related to the postwar planning activities of local units of the Committee for Economic Development, chambers of commerce, and all other groups that have interested themselves in postwar economic and construction planning.

MARK B. OWEN

In its personnel, the Committee is especially fitted to function with understanding and efficiency. Mr. Smith has been on the editorial staff of *Construction Methods* for the past 17 years, and is also serving as postwar construction consultant for the McGraw-Hill periodicals. Mr. Owen has had many years of good experience in municipal work, as well as widespread industrial activities throughout the country. He is a past-president of the American Public Works Association.

This forward step in Society activity promises well for the success of the overall program contemplated. It looks toward active cooperation in a nation-wide effort to assure jobs for discharged service men and released war workers after the end of hostilities. The prestige of the organization is behind this ambitious plan to bring to realization the ideal of an efficient postwar program.

The Committee on Postwar Construction has been enlarged by the appointment of Charles T. Leeds of Los Angeles, former Director of the Society, and Hal H. Hale, formerly the Society's representative in Washington, D. C. The previous members remain—Adolph J. Ackerman, Dean G. Edwards, Frederick H. Fowler, Gustav J. Requardt, Frank T. Sheets, and G. Donald Kennedy, Chairman.

The Engineer in Foreign Service

VIII. A Texan with the Armed Forces

By ALBERT H. POLLARD, ASSOC. M. AM. SOC. C.E.
CAPTAIN, CORPS OF ENGINEERS, U.S.A.

The following are excerpts from a letter written December 20, 1943, by Captain Pollard to the Secretary of the Texas Section and printed in the March 1944 issue of "The Texas Engineer." The Captain went overseas in June 1942.

AFTER the usual orientation I found myself in southwest England in a Base Section Engineer office engaged in construction of housing, warehousing, and airfield. I soon made a number of British friends and lived with an architect and his wife who made me feel exactly as if I were one of the family. The impression one gets of the country is that it is like a garden, always green and well kept, each scene like what one might see in a picture. Things have an air of permanence. One comes upon a cottage that was built in the year 1100 or 1700 and it is difficult to realize that there is much difference between it and one built at a later date. Once I was in Wells Cathedral, which took several hundred years to build. Nothing has been added to it for the past 500 years. Things are dated according to the reign of King So-and-So. The first office I was in was about 400 years old and I have a friend who lives in a little country cottage built over 200 years ago. In the section where I was, either ancient stone walls or hedges separated the fields. There are hundreds of miles of blackberry hedges. I certainly did enjoy those blackberry and apple dumplings.

Owing to pressure of work, I was able to do little traveling about pleasure-seeking. I did have the opportunity to spend two days in London and a busy two days it was. I cannot take time to describe the trip. Went through Westminster Abbey, St. Paul's Cathedral, saw the Houses of Parliament from the outside, made quick trips around to see the principal points of interest.

Impressive things that registered indelibly on me might be considered unimportant to others. I see in my mind's eye a foggy night when I strolled along Hyde Park when the misty glow revealed only the nearby objects, when even the anti-aircraft defenses were softened until they seemed almost a part of the normal landscape; actually I was lost trying to find a way back to my billet but I drank in the beauty of the scenes, not much caring whether I soon discovered my location or not; then the other night when I stood for a long time, in a city of millions of people, yet quite alone, gazing at Trafalgar Square in the moonlight, wondering why the world was indulging in a crazy war. Other little things were those such as whisking about in the tubes far underground; sweet corn for sale at a confectioner's booth in the Paddington Station; little taxis that turn around in the middle of the narrow streets; the booming of Big Ben; the extreme politeness of the Bobbies; the continuous strings of perambulators, all containing one or more babies, but some with dogs and vegetables as well; innumerable bicycles, some tandem and some with trailers, some ridden by five-year-olds, and some ridden by eighty-five-year-olds; the difficulties with transactions with guineas, pounds, half-crowns, florins, thruppence, tuppence, pennies, h'ap'nies, and farthings.

Some of the things were not so little. The queues for everything imaginable, for purchasing toilet articles, fish, meat, clothing, or waiting hours for a tram or bus; the complete blackout every night, year in and year out, the bombed-out areas, particularly where St. Paul's stands surrounded by acres of leveled areas and then, most magnificent of all, the will and quiet determination of the people practically beaten to their knees in 1940, yet cheerful and resolute to a man, woman, and child in their daily effort to bring about the defeat of an enemy who expected to invade their homeland; to do this they were raising all the foodstuffs their gardens and allotments would yield and they were cheerfully and enthusiastically foregoing and denying themselves things that we consider necessities. Well, I cannot put down all of my impressions but the opportunity may come some day when I can write you of more of them. Hope you are not bored with the few I have given.

England is quite cool all summer long. For the first week, which time it took me to become more or less acclimated, I found it necessary to use a bit of heat in my room. It was illegal, since it was August, no, July, but I was cold. I soon became accustomed to 50 to 60-degree temperature so I did not need the fire. We wore wool all summer. I was duly grateful not to be bothered with hayfever, and have had none in N. Africa. Some objected to the fact that rain fell so often in England but it did not bother me much.

While we worked only seven days per week and were generally able to leave the office by ten or eleven at night. While I was in England I was able to spend all of my leisure time very profitably. Occasionally I had to make trips to nearby towns and was able to wangle a three-day leave when I went to London. I bought an English bicycle a few days after I was settled. When it was not raining (and sometimes when it was) I managed to see different parts of the town by selecting various routes from my office to the house. Having three speeds to the bike enabled me to negotiate the hills without difficulty....

We went ashore in North Africa on December 6. Very surprised to find that some of the cities have tall modern buildings. I found my Spanish came in handy as nearly everyone seemed to know it.

The principal roads are few but the main route is paved across Northwest Africa. In my travels I have covered a strip about 500 miles along the coast. I have not seen any camels, elephants, lions, and such, but plenty of Arabs, dogs, cats, and burros. I have lived within sight of the sea all of the time in two cities. Lately I have been able to see the tops of snow-covered mountains and hope to go skiing soon, if I can get a day off and the transport at the same time. This past summer a policy was established for each person to have a day off and transport to the beach was made available. We went swimming once a week and we all became very tanned. The water is cold but the sun is very hot. The air temperature remains fairly low. In my office the highest point reached was eighty so you can realize that this is a very comfortable climate, particularly when I tell you that the winter temperature here rarely drops below fifty.

When my off-day comes around I really appreciate it and relax completely. Both at my former station and here I have been very fortunate in making friends with several French families; the social contacts have assisted greatly in keeping me from feeling too

mesick, as well as giving me an opportunity to practice French d to get some relief from GI rations by partaking of some of the nderful French cooking each week.

Last Christmas I was invited to have turkey dinner with a ench family. On account of Darlan's assassination on Christmas re we were all placed on an armed alert and were forbidden to ve our posts. At 12:10 p.m. I had prepared a note of regrets send around to the family to tell them that I could not attend. he C.O. happened to come to my desk just as I finished the note d I remarked to him that I was in the process of doing the most rettable deed since my arrival in Africa. The outcome of two nutes conversation was that I was excused for enough time to eat. eft my address and then sallied forth. When I finished eating it as 10 o'clock that night. I went to the office. Everything was aceful so I rolled into bed and dreamed of the wonderful meal.

Air raids have been very scarce during the past few months. uring the last one I was outside and saw a German plane shot own by flak. We are very grateful not to have to scurry to shelter the middle of the night. Air-raid shelters are good places to arn French as everybody talks violently all of the time, at least e French do, but I prefer to absorb mine over the dinner table.

Our organization is composed of British and American personnel. y section chief is an American Colonel, my sub-section chief is a itish Major, and in my immediate office there are other British ficers and enlisted men. We work in very close harmony, the nly complaint being from the friends of our British co-workers, ho state that they cannot understand the Texas accent that pre-ails over the former pure English language of their comrades. f course, the Californian objects somewhat, but it is not too ifficult to overrule his objections, if not by logic, at least by volume.

Often I think of all of you back home and wish I could write ersonal letters. I hope that this effort will prove of some interest. t will at least let you know that I am O.K., that I have not for-otten you and am wishing to be back with you as soon as possible.

Frank Reul

FRANK REUL was a standby on the Society's staff. It is hard to hink, and harder to say, that he will not come back. For nearly ight years he was a definite part of the organization—industrious, leasant, and efficient. Then the war took him. Sometimes war oes not return what it borrows; and this is what happened to rank.

When first he came to the office, he was just a school boy. First messenger, but gradually taking on more responsibility, he became significant part in the mailing and clerical department. He was the kind of chap to whom a job could be given and then forgotten. Frank would never let you down.

FRANK REUL, 1918-1944

Everyone was sorry to see him go. Two years ago it was. News came from him quite frequently; one of his letters was published in the November 1942 CIVIL ENGINEERING. He was promoted to the rank of sergeant in the Engineer Corps and in due course he was sent abroad with his unit. Finally he reached the Anzio beachhead. It was there that a German shell found him on March 5.

In the course of years Frank had grown to man's estate. He married his schooldays' sweetheart and established his own home. He took a man's place in the world and he paid a man's price for his heritage. But to those in the Headquarters office he was still one of the "boys." The staff and the Society were made richer through the work and character of Frank Reul.

Membership Identification for Service Men

IT IS generally known by those in civilian life that military regulations prohibit the wearing of membership or fraternal insignia by commissioned officers and enlisted personnel of the Army and Navy. Many Society members have written to Headquarters requesting some means of identification, since the badge or pin may no longer be worn until return to civilian status.

To meet this increasing demand, an identification card for service men has been printed and will be issued upon request to Society members in good standing who are in uniform with the Armed Forces. It is estimated from the sale of pins and badges prior to World War II, that 80 to 90% of the Corporate Members and Juniors identify themselves as members by displaying the Society insignia. The identification card should prove helpful to service men traveling both at home and overseas when visiting local, state, or national engineering societies of which they are not members. Generally, mail and reading-room facilities are available to Society members, and in some cases room accommodations may be had.

The card will be issued as a temporary expedient, annually, for the duration. Thereafter it is believed that members will prefer to resume the wearing of the badge or pin.

News of Local Sections

Scheduled Meetings

ALABAMA SECTION—Semiannual two-day meeting at the Whitley Hotel in Montgomery, Ala., on May 12 and 13.

COLORADO SECTION—Dinner meeting at the Edelweiss Restaurant on May 8, at 6:30 p.m.

ITHACA SECTION—Joint meeting with the Technical Societies of Broome County at the Arlington Hotel in Binghamton, N.Y., on May 19, at 6:30 p.m.

NEBRASKA SECTION—Dinner meeting at the University Club in Lincoln, Nebr., on June 6, at 6:45 p.m.

OKLAHOMA SECTION—Dinner meeting at the Michaelis Cafeteria in Tulsa, Okla., on May 8, at 3:30 p.m

SACRAMENTO SECTION—Regular luncheon meetings at the Elks Club every Tuesday at 12:15 p.m.

ST. LOUIS SECTION—Luncheon meeting at the York Hotel on May 29, at 12:15 p.m.

SEATTLE SECTION—Technical meeting at the Hydraulics Building of the University of Washington on May 29, at 7:30 p.m.

TEXAS SECTION—Luncheon meeting of the Dallas Branch at the Adolphus Hotel on May 1, at 12:15 p.m.

TRI-CITY SECTION—Dinner meeting at the Muscatine Hotel on May 18, at 6:30 p.m.; inspection trip at 5:30 p.m.

WEST VIRGINIA SECTION—Talk on "Postwar Problems for West Virginia" at a dinner meeting at the University Cafeteria in Morgantown, W.Va., on May 12 at 6:30 p.m.

Recent Activities

BUFFALO SECTION

The March meeting of the Buffalo Section took the form of a joint evening session with the Engineering Society of Buffalo. Invitations had been sent to the other technical societies in the Niagara area, and there was a capacity audience. The speaker of the evening was A. C. W. Siecke, who gave an illustrated lecture on the raising of the former French liner, *Normandie*. Mr. Siecke is consulting engineer for the Merritt, Chapman and Scott Corporation, which was in charge of salvage operations.

CENTRAL ILLINOIS SECTION

On February 29 members of the Springfield Engineers' Club were guests of the Section to hear Capt. Arthur B. Colliflower, of the U.S. Army Air Corps, speak. Captain Colliflower explained, with the aid of a chart, the operation of the Army's portable oxygen-

generating units. These units, mounted on large trucks, extract oxygen from the atmosphere. The oxygen is then compressed, cooled, liquefied, and finally bottled in steel cylinders for the use of aviators, especially at the higher altitudes. The speaker at the March meeting was Prof. J. J. Doland, supervising engineer of the University of Illinois Airport, who discussed the reason why a Class 4 airport was wanted in that region, and the obligations involved in building and operating it. An interesting feature of construction work was the drainage system, which provides for retention ponds that can store a one-hour rain of 1.6 in. for a period of two hours. The April meeting was devoted to a discussion on the subject of collective bargaining.

DISTRICT OF COLUMBIA SECTION

At the February meeting of the Section G. Donald Kennedy, chairman of the Society's Committee on Postwar Construction, discussed some of the problems that will arise in postwar construction and emphasized the necessity of planning now for the peace. Discussion was led by Col. W. N. Carey, chief engineer of the Federal Works Agency; Gail Hathaway, head engineer for the U.S. Corps of Engineers; Earnest Boyce, senior sanitary engineer for the U.S. Public Health Service; Clifford A. Betts, civil engineer for the U.S. Forest Service; and F. W. Tuemmler, of the Maryland National Capital Park and Planning Commission. The technical program consisted of a talk on the effect of construction on our national economy—given by C. M. Upham, engineering-director for the American Road Builders' Association.

ILLINOIS SECTION

The Illinois Section has recently had two joint meetings. On February 10 there was a joint luncheon with the Chicago Engineers' Club, at which Earl J. Felt spoke on the classification and characteristics of soils. Mr. Felt, who is assistant engineer for the Soils Cement Bureau of the Portland Cement Association, explained the formation and classification of soils and their moisture-density relationship and the relation of these factors to load-bearing tests. The March meeting took the form of a joint session with the Western Society of Engineers. Preceding the technical program, the Section entertained at dinner in honor of the speaker, Wilbur M. Wilson. Professor Wilson, who is a Director of the Society and research professor of structural engineering at the University of Illinois, spoke on "Fatigue as a Factor in Structural Design," giving a summary of the work in this field that has been under way at the university for a number of years.

INDIANA SECTION

A discussion on the increasing utilization of mechanical horsepower by military units comprised the technical program at the March 3d meeting of the Section. This was given by Alfred Campbell, vice-president of Marmon-Herrington, Inc., who cited personal experiences with engineers from foreign countries, who come to the Marmon-Herrington plant for instruction in the use and maintenance of equipment. During the business session Frank C. Tolles, Director of the Society, discussed Society Affairs of interest to the Section.

ITHACA SECTION

Recent meetings of the Ithaca Section have been addressed by Ellsworth L. Filby, principal assistant engineer for Black and Veatch, of Kansas City, Mo., and Dr. L. A. Maynard, professor of nutrition and director of the U.S. Nutrition Laboratory at Cornell University. The former spoke on postwar planning, while Dr. Maynard's subject was "Wartime and Postwar Food Problems." The March meeting took the form of a joint session with the Cornell University Student Chapter, which was addressed by Howard E. Whitney. Mr. Whitney, who is construction superintendent for Agfa Ansco, of Binghamton, N.Y., gave an illustrated talk on "Power Development on the Susquehanna."

KANSAS CITY SECTION

"Superhighways for Kansas City" was the subject of discussion at the March 24th meeting of the Section. This was presented by John M. Picton, chief planning engineer of Kansas City, who introduced his talk with a review of the subject of city planning, coming down to the present day with its rational and practical method of attacking the problem of zoning. Mr. Picton had a number of charts showing the relationship between population density, topography, and existing transportation facilities.

KANSAS SECTION

At the annual business meeting of the Section—held in Topeka on February 11—the following new officers were elected for the coming year: L. V. White, president; George S. Knapp, vice-president; and John W. Frazier, secretary-treasurer. An inspection trip through the Seymour Company's egg-drying plant at Topeka was the feature of the technical program at the March meeting. Preceding the trip, E. C. Heinsohn explained the operation and output of the plant.

LOS ANGELES SECTION

On March 8 Howard F. Peckworth, assistant to the Secretary of the Society, addressed the regular monthly dinner meeting on the subject of collective bargaining. Next on the program was Robert E. Vivian, dean of the college of engineering at the University of Southern California, whose subject was "Our Engineering Colleges at War." The final speaker was a member of the Army Air Corps—Lt. Thomas C. Dick—who described the rigors and horrors of taking Flying Fortresses and other bombers over Germany, France, the Near East, Italy, and the Ploesti oil fields. Wounded in his first flight over Occupied France, Lieutenant Dick gave a vivid description of his reaction. He is the recipient of numerous awards and decorations for his successful sorties.

MARYLAND SECTION

At the regular March dinner meeting Brig. Gen. C. L. Sturdevant, assistant chief of engineers of the U.S. Army, spoke on "Engineer Operations in Overseas Theaters." General Sturdevant, who recently returned from a tour of the Alaskan Highway and an inspection of engineer installations throughout the Pacific area, described in detail the activities of the combat engineers, aviation engineers, and the Alaska service troops in the various war areas and showed slides, depicting Army Engineers at work in these theaters of operation. A short sound film, entitled "They Deliver the Goods," concluded the program.

METROPOLITAN SECTION

"Welding in Postwar Steel Construction" was the subject of discussion at the March 15th meeting of the Section, the principal speaker being LaMotte Grover, welding engineer for the Air Reduction Sales Company, of New York, N.Y., who had prepared an illustrated paper on the subject. Mr. Grover discussed war developments in the structural steel fabricating industry, which forecast an extensive use of structural welding, and described details of design for ships, bridges, and other large welded structures, intended to insure sound workmanship and avoid serious shrinkage strains and distortion. The paper concluded with a review of what has been learned from experience and research.

During March the Junior Branch of the Section held two meetings. The "warspeed" method of constructing industrial buildings was described by C. S. Evans, of the Mahoney-Troast Construction Company, at the March 8th meeting. Moving pictures illustrated his talk. On March 22, Lee Fah Yih, of the China Institute of America, spoke on "The Development of China in the Postwar Years." Dr. Yih estimates that 180,000 engineers of all branches will be required to direct the reconstruction of China.

MICHIGAN SECTION

The February 4th meeting of the Section, which took place at the University of Michigan in Ann Arbor, was devoted to business discussion. Later in the month there was a meeting in Detroit, at which Lt. Col. Arthur B. Morrill, senior sanitary engineer for the U.S. Public Health Service, spoke. Colonel Morrill, who was formerly engineer of sewage treatment for the city of Detroit, discussed his experiences during the past two years in Burma, India, and China, stressing the work of the Public Health Service and its efforts to further the war effort by improving sanitary conditions in the Far East. Since Colonel Morrill had spent some time in China a number of years ago he was able to make interesting comparisons.

MID-MISSOURI SECTION

On March 24 members of the Mid-Missouri Section gathered at Rolla for a dinner meeting. The principal speaker was Curtis L. Wilson, dean of the Missouri School of Mines, who discussed the international, racial, and labor situations with which the engineer will have to cope in his work after the war. Dean Wilson

pressed the fact that the engineer will not be able to do his work well if he does not have a proper perspective on these problems.

NEW MEXICO SECTION

The February meeting of the New Mexico Section took the form of a joint session with the New Mexico Society of Engineers held at the time of the Ninth Annual Highway Engineering Conference in Albuquerque. Collective bargaining for engineers was the subject of discussion, the principal speaker being Raymond A. Hill. At the March meeting, which was held in Santa Fe, Gordon Ferguson spoke on the relationship between the architect and the engineer. Mr. Ferguson is associate professor of civil engineering at the University of New Mexico.

NORTHEASTERN SECTION

During the annual business meeting—held in Boston on January 24—the following new officers were elected for the coming year: Francis H. Kingsbury, president; William M. Bassett, vice-president; and Emil A. Gramstorff, secretary-treasurer. The speakers and guests of honor were Richard Shaw, president of the Massachusetts State Association of Architects, who discussed the necessity of cooperation between engineering and architectural groups; and Charles M. Spofford, Boston consultant and former Vice-President of the Society, whose subject was the current work and status of the Society. Speakers and guests of honor at the March dinner meeting of the Section were Malcolm Pirnie, newly elected President of the Society; James E. Jagger, Acting Assistant Secretary of the Society; and Charles B. Breed, Director from District 2. All discussed various phases of Society affairs. Lt. Comdr. Eugene J. Peltier, of the Civil Engineering Corps of the U.S. Naval Reserve, concluded the program by showing a film on the Sea Bees.

NORTHWESTERN SECTION

On April 3 the Section had for guests a number of Student Chapter members. Following dinner, prizes of engineering handbooks were presented for scholastic achievement at educational institutions in the District. The recipients were James Peterson, of the South Dakota State School of Mines; William M. McEnroe, of the University of North Dakota; and Quentin Bohne, Norbert Dierson, and John Loeffler, of the University of Minnesota. The meeting was then turned over to F. W. Thorstenson, president of the Junior Forum, which was in charge of the program. Mr. Thorstenson introduced Robert E. Albrecht, of St. Paul, who presented an outline of postwar plans for St. Paul.

OKLAHOMA SECTION

The first 1944 meeting of the Oklahoma Section, which was held in Oklahoma City on March 18, consisted of two sessions—a business meeting in the afternoon and a technical program following dinner in the evening. The principal speaker at the second session was Maj. Lee Owens, professor of history at Oklahoma City University. Major Owens spoke on the coming invasion of Western Europe and discussed the probable disposition of Germany after victory.

PITTSBURGH SECTION

A joint meeting with the Engineers' Society of Western Pennsylvania took place on February 29. Other participating groups were the Pennsylvania Society of Professional Engineers and the Pittsburgh section of the Society of American Military Engineers. A talk on the activities and accomplishments of the Sea Bees comprised the technical program, the speaker being Comdr. Harold B. Buse, assistant director of the Construction Division of the Bureau of Yards and Docks. The March meeting was given over to a discussion of the report of the Committee on Employment Conditions. Howard F. Peckworth, assistant to the Secretary of the Society, was the speaker.

PROVIDENCE SECTION

The Providence Section held two meetings in March. On the 8th Archie N. Carter, assistant editor of *Engineering News-Record*, gave an illustrated talk on the building of the Inter-American Highway. Mr. Carter recently returned from a trip to view this highway project, so he was able to give many interesting details of living conditions in the countries through which the road passes. On the 24th, Capt. Paul J. Halloran, of the Civil Engineering Corps of the U.S. Navy, explained the under-water method of concreting naval drydocks.

SACRAMENTO SECTION

On March 14, the Section was privileged to witness the first showing in Sacramento of the film, "War Department Report," prepared by the General Staff for the information of Congress. On the 21st, Mark Falk, of the Los Angeles Section, reported on how the Board of Registration of Civil Engineers, of which he is a member, has met various war problems. At the final meeting of the month, State Mineralogist Walter W. Bradley recited the disappointing history of the steel industry in California, concluding that the future was bright for electric furnace alloy steel, but that blast furnaces could not afford to pay more than 1.5 mills per kwhr.

ST. LOUIS SECTION

A special meeting of the St. Louis Section was called on February 28 to discuss collective bargaining. The technical program at the March meeting featured a talk by D. Howard Doane, chairman of the new Missouri State Commission of Resources and Development. Mr. Doane stated that broad powers have been given the commission to investigate the natural resources and possibilities of industrial development in the state and outlined some of the resources that will be investigated.

SYRACUSE SECTION

The Syracuse Section reports dinner meetings in January and March. At the first of these W. G. Bickel, chairman of the Carrier Corporation Postwar Planning Committee, discussed the problems confronting postwar industry. The speaker and guest of honor at the March meeting was William I. Meyers, dean of the New York Agricultural College at Cornell University. His topic was "The Current Food Situation and the Future Outlook."

TACOMA SECTION

Matters of interest to the Pacific Northwest formed the topic of discussion at the February dinner meeting of the Section. First Arthur Johnson, hydraulic engineer for the Water and Power Division of the U.S. Geological Survey, reported on mapping and river survey work being carried on in the Northwest in connection with the possible future development of hydroelectric projects. Numerous possible sites were discussed, and maps showing the extent of the surveys being made were displayed. Then Fred M. Veatch, district engineer for the Survey, presented a report on the timber resources of the state of Washington, illustrating his talk with graphs and maps. The report emphasized the need of a more complete timber economy for the state if a sustained yield of timber is to be attained.

VIRGINIA SECTION

The annual meeting of the Virginia Section took place in Richmond on February 18. Following dinner, the new officers were introduced. These are T. W. Roby, president; Richard Messer, first vice-president; R. A. Marr, Jr., second vice-president; and R. Stuart Royer, third vice-president. P. A. Rice continues as secretary-treasurer, and C. L. Torrence was appointed his junior aide. A talk by Gen. James A. Anderson on postwar public works comprised the technical program. General Anderson, who is commissioner of the Virginia Department of Highways, believes that such public works should be self-liquidating and that the plans for them should be so complete that work can be started immediately after the close of the war. In the discussion that followed A. J. Saville stated that, in his opinion, private construction would have to provide the greatest part of postwar construction and that the public should be educated to this idea.

WISCONSIN SECTION

The use of air-entraining cement was described at the March 30th meeting of the Section by W. D. Kimmel, district engineer for the Portland Cement Association. In his talk Mr. Kimmel pointed out that "concrete pavement built with air-entraining portland cement is highly resistant to freezing and thawing and to the application of salt and sodium chloride to remove ice." Some salts eat into the surface of other pavements and cause unsightly scaling. Robert A. Burmeister, city testing engineer for Milwaukee, next described the city's success with this type of cement and stated that their specifications now require its use on all concrete pavements. Colored motion pictures on soil-cement construction and limited access roads concluded the program. The February meeting was given over to a discussion of collective bargaining.

ITEMS OF INTEREST

About Engineers and Engineering

Fiftieth Anniversary Celebrated by Underwriters Laboratories

ENGINEERS and contractors have long depended upon products approved by Underwriters' Laboratories, Inc., because of their reliability. Not many, however, know the history of service upon which this reputation has been built. The Underwriters' Laboratories is a non-profit organization, sponsored by the National Board of Fire Underwriters, and was started in Chicago in 1894. The first laboratory was a single room over Fire Patrol Station No. 1 on Monroe Street, and its primary function was to follow the fire horses to each call and determine the cause of the fire—if possible.

About this time the United States began to see the birth of many new industries. With the accidental discovery in North Carolina in 1892 of a method of making acetylene gas commercially, its use for lighting soon became known and before long tinsmiths and druggists in many towns collaborated to produce acetylene lighting equipment for homes, stores, hotels, and offices. Widespread use of these crude generators, made with little knowledge of the hazardous nature of the gas employed, resulted in explosions and fires, and loss of life and property. The testing of acetylene generators and lighting equipment became an important activity for the small laboratory, which with its meager testing equipment and hand-made apparatus became cluttered with acetylene generators, spark arresters, gasoline and kerosene lamps, electrical wiring devices, and arc-lighting equipment. Whether the blowing of one or more acetylene generators through the roof had anything to do with it is not clear, but it is known that some of the overflow of these devices waiting for test was moved to other buildings where additional space was obtained.

Outgrowing its original and supplementary locations, the organization now moved to a brick building at 67 East 21st Street, Chicago, which had been a school and gymnasium. This was the first complete building to be occupied by the Laboratories and it seemed amply spacious, but with the influx of new devices for test, it too became overcrowded in a few years. Construction of an Underwriters' Laboratories' building seemed to be the solution.

"The City Unburnable," as the present main testing station on Ohio Street in Chicago has been rather loosely termed, was begun in 1904 on land acquired on a 99-year lease, and later purchased. The first unit, only a small building 50 by 100 ft, three stories and a basement on the front half, and one story in the rear, was occupied in 1905. Five or more additions since the original building was erected give the testing station a total of approximately 130,000 sq ft of floor area. The buildings in this group were designed to be, and are today, among the best examples of fire-resistant construction in the country.

In the fifty years that have elapsed since its origin, the objectives of Underwriters' Laboratories, or its reasons for being, have remained the same—to reduce the dangers to life and property. Fire, the original consideration, is still the principal one at the Laboratories today. The prevention of other hazards, however, is also included in the scope of activities. Once the engineers were jacks of all trades; today they are specialists in either the protection, hydraulic, gases and oils, chemical, electrical, casualty and automotive, or burglary protection departments.

To date 375,000 products have been approved by the Underwriters' Laboratories and are listed in its booklets of tested and inspected items. As 50% fail the first time they are tested, many more than 375,000 products have been investigated. The 5,000 manufacturers of approved devices, materials, and systems produce in a normal year, in their more than 5,500 factories, half a billion of these safeguarded articles. The laboratory has every right to be proud of its accomplishments in these 50 years. In rendering this service, it is the only successful organization of its kind in the world.

Reinforcing Specifications Revised

NATIONAL Emergency Specifications for reinforced concrete buildings (War Production Board Directive 9) have been amended to increase the amount of reinforcing steel that may be utilized, to exempt from their provisions small projects using less than 5 tons of steel, and to eliminate some of the paper-work requirements for the construction industry.

A similar reduction in paper-work requirements was made in Directive 8, governing structural steel for buildings, and Directive 29, governing stress grade lumber for buildings. Simultaneously, Directive 8 was amended to exempt from the specification provisions any project using less than 5 tons of steel. The amendments to the three directives became effective March 30, 1944.

In reinforced concrete construction, WPB Directive 9 is amended to permit the use of about 5% more reinforcing steel, with a consequent reduction of about 10% in the size of concrete beams and columns. This will reestablish design practices that were in common use before the war. From now on it will not be necessary for building designers to file a certificate declaring that the National Emergency Specifications for the design of Reinforced Concrete Buildings have been followed. Building projects involving the use of 5 tons or less of reinforcing steel are now exempt from the necessity of complying with the national emergency specifications. However, the increased working stresses in reinforcing steel required by the original emergency specifications have not been modified in this amendment.

N. G. Neare's Column

Conducted by

R. ROBINSON ROWE, M. AM. SOC. C.E.

LAST March Professor Neare made a problem of the portward winding trail of the *USS Sidewinder* after a bomb straddle bent its keel to a 15-ft middle ordinate. Later some of us engineers expressed skepticism. "It's fact," persisted the Professor, "except that names of vessel and correspondent had to be concealed in aliases for the duration. The skipper was a bright chap; assuming him perfect, how long did it take him to reach port?"

"I'll cut and try for a start," offered Joe Kerr. "Obviously the ratio of s (around the loop AB) to l (the tern-line distance AB) must be a minimum. Now $s = 24\alpha + \pi$ and $l = 24 \sin \alpha$; letting $\frac{d}{d\alpha}\left(\frac{s}{l}\right) = 0$. I found $\alpha = \tan \alpha - \frac{\pi}{24} = 0.68342$ (by cut-and-try). Then $s/l = \sec \alpha = 1.2896$ and the elapsed time will be $1.2896 \times 250/30 = 10.747$ hours."

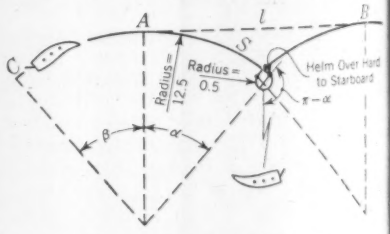
"Not unless the distance to port is an exact multiple of AB, which it isn't," protested Ken Bridgewater. "I'd run 16 full loops plus 3.75 miles at each end—in 10.678 hours."

"Better yet," advised A. N. Nutt, "let the end arcs CA subtend an angle β. Then if n is the number of loops, the total arc distance $S = 25\beta + 24n\alpha + n\pi$ and $L = 250 = 25 \sin \alpha + 24n \sin \beta$. Letting $\frac{\delta}{\delta\alpha}\left(\frac{S}{L}\right) = 0$, we find $\beta = \alpha$. Obviously $n = 16$, whence $\sin \alpha = 250/409$ and the elapsed time will be 10.6413 hours."

"Very, very, very close," conceded the Professor. "But after finding $\beta = \alpha$, you should have expressed S in terms of n:

$$S = n\pi + (25 + 24n) \sin^{-1} \frac{250}{25 + 24n}$$

Then letting $dS/dn = 0$, you would have found $n = 15.456$. Since n must be an in-



THE "SIDEWINDER" LOOP

...er, it is more likely to be 15 than 16. ...fact for $n = 15$, $\sin \alpha = 50/77$ and the ...psed time is 10.6405 hours, a saving of ...8 sec. This was a max-min problem in ...o variables where one variable must be ...integer, a combination I've never seen ...texts.

"Now, before the argument begins, I ...nt to tell of a party of Sea Bees and ...laves that crash-landed on Knott Atoll. ...nowing that rescue from this uncharted ...ef was improbable and that overpopula...on of the island would mean starvation, ...e ten survivors drew up and signed a ...acific Charter, which read in part: 'We, ...e undersigned first generation on Knott ...toll, bind ourselves and our descendants ...o this code—first, the Ten Command...ents; second, there shall be no intermar...iage between different generations or be...ween first cousins; third, no woman shall ...ear more than three children. . . .' To ...hat population did the Charter limit the ...ourth generation on Knott Atoll?"

[There were no Cal Klaters. Closest ...ere the anonymous A. Nuther Nutt, Richard Jenney (10.649 hours), Leon Bes...in (10.667 hours), A. M. Woodall (10.678 ...ours), and A. M. G. . . . (10.690 hours). ...Some of these were landlubbers who as...umed the data were in statute miles; for ...omparison, their answers have been multi...plied by 1.15155. Also acknowledged are ...orrect delayed-in-the-mail solutions to the ...lippery-ladder problem (February) from ...oy W. Borders, Samuel B. Folk, John C. ...Prior, and Walter L. Shilts.]

Re-Survey of "Second Mile" Published by E.C.P.D.

PROFESSIONAL development of young engineers is the concern of a new pamphlet, "The Second Mile, a Re-Survey," by W. E. Wickenden, which has recently been published by the Engineers' Council for Professional Development. Dr. Wickenden, who is president of the Case School of Applied Science, has revised his earlier work, "The Second Mile," with the goal of presenting especially an appeal to the ambitions of young engineers.

The differences between a technician and a professional person are clearly presented, along with the need of an engineer for his profession. As the title, which is taken from the Sermon on the Mount, implies, the author insists that an obligation is assumed by every person entering a profession to render a service over and above that required by assigned tasks.

Over 16,000 reprints of the earlier pamphlet have been circulated, mainly by schools, societies, and industries. Indeed it was because of the enthusiastic reception of the original address that Dr. Wickenden was persuaded to prepare the new shortened and modified version. Copies of the new edition can be obtained from the Engineers' Council for Professional Development, 29 West 39th Street, New York 18, N.Y. The price is $3.00 per hundred, 5 cents each in small quantities, and 10 cents for a single copy.

NEWS OF ENGINEERS

Personal Items About Society Members

CHARLES E. DE LEUW has returned to private consulting practice in Chicago after serving for several years on the construction of the Chicago subway in the capacity of acting chief subway engineer.

EDWARD W. BUSH announces his retirement as engineer for the Aetna Casualty and Surety Company, of Hartford, Conn., with which he has been associated since 1917. His position will be filled by THOMAS FRAHER, formerly field engineer in the bond department of the company.

JACOB WEGWEISER has been promoted from the rank of lieutenant (jg) in the Civil Engineering Corps of the U.S. Naval Reserve to that of lieutenant. For the past year he has been serving in the South Pacific as a civil engineer officer in the Construction Battalions.

J. MONROE JOHNSON has received President Roosevelt's appointment as Director of the Office of Defense Transportation to succeed the late Joseph B. Eastman. A native of South Carolina, Colonel Johnson has been a member of the consulting firm of Johnson and Roberts, of Marion, S.C., since 1898. From 1935 to 1940 Colonel Johnson was Assistant Secretary of Commerce, and since 1940 he has been a member of the Interstate Commerce Commission, with headquarters in Washington, D.C. Colonel Johnson was a volunteer in the Spanish-American War and served overseas with the 17th Engineer Regiment in the first World War, rising from the rank of major to that of colonel in command of the regiment.

J. MONROE JOHNSON

ROY W. CRUM, director of the Highway Research Board of the National Research Council, was elected president of the American Concrete Institute at the annual meeting of the organization, which was held in Chicago on March 2. At the same meeting two other members of the Society—DOUGLAS E. PARSONS, of the Bureau of Standards in Washington, D.C., and JOHN R. NICHOLS, Boston consultant—were elected vice-presidents of the Institute.

JOHN C. H. LEE, deputy theater commander and commanding general of the Army Services of Supply in the European theater, was recently promoted from the rank of major general to that of lieutenant general. Two other members of the Society in the Services of Supply—HARRY B. VAUGHAN and EWART G. PLANK—have been promoted from the rank of colonel to that of brigadier general. The former is commander of the western base section of the Services of Supply, while General Plank commands the eastern base sector.

EUGENE T. CRANCH, formerly president of the New Rochelle (N.Y.) Water Company, is now director of public works for the City of New Rochelle.

WILLIAM N. DOWNEY, of Arlington, Va., has been appointed engineer of bridges in charge of the bridge department of the Seaboard Air Line Railway.

HERMAN D. BRICE, hydraulic engineer for the U.S. Geological Survey, was recently transferred from the Albany (N.Y.) office of the Survey to the Jamaica (N.Y.) office. He will be in charge of stream-gaging activities in Westchester, Nassau, and Suffolk counties.

WILLIAM H. WISELY has resigned as engineer-manager of the Urbana-Champaign (Ill.) Sanitary District in order to devote full time to his duties as executive secretary and editor of the Federation of Sewage Works Associations.

FRANK R. S. LAYNG, chief engineer of the Bessemer and Lake Erie Railroad, is the new president of the American Railway Engineering Association. He was elected to this office at the annual meeting of the Association, which was held in Chicago, March 14 to 16.

SAMUEL M. ELLSWORTH, consulting engineer of Boston, Mass., was elected president of the Boston Society of Civil Engineers at the 96th annual meeting of the organization, which took place on March 22. Other members of the Society honored at the meeting include RALPH W. HORNE, of the Boston firm, Fay, Spofford and Thorndike, who received the Desmond FitzGerald Medal; and THOMAS R. CAMP, professor of sanitary engineering at Massachusetts Institute of Technology, who was awarded the hydraulics section prize. ARTHUR T. SAFFORD, consulting engineer of Lowell, Mass., was elected to honorary membership in the organization during the meeting.

STANLEY T. BARKER has been promoted from the rank of commander in the Civil Engineering Corps of the U.S. Naval Reserve to that of captain. Captain Barker, who is a member of the U.S. Naval Aviation Mission to Lima, Peru, is serving as Director de Construcciones Civiles in the Cuerpo Aeronautico del Peru (the Peru-

vian Air Force) and has the relative rank of Colonel in the C.A.P.

F. E. SPURNEY recently joined the staff of Luther and Wood, engineers of Washington, D.C. For the past five years Mr. Spurney has been building engineer for the Board of Governors of the Federal Reserve System, with headquarters in the same city.

S. C. GODFREY, brigadier general, Corps of Engineers, U.S. Army, has been awarded the Legion of Merit. The citation accompanying the award reads in part: "For exceptionally meritorious conduct in the performance of outstanding services as engineer, GHQ Air Force, and Air Force Combat Command, from May 21, 1941, to March 8, 1942. General Godfrey rendered distinguished service in directing the growth of the aviation engineer component of the Army Air Forces. . . . His personal contribution to the development of the transportable steel landing mat is an achievement of outstanding note." General Godfrey is now with the Army Air Force in the India Burma Sector of the China Burma India Theater.

JOSEPH K. GANNETT, vice-president of the Austin Company and, since 1928, eastern district manager, has been appointed director of engineering, in charge of engineering and research, with headquarters in New York.

DECEASED

WILLIAM WESLEY AMBURN (M. '13) civil and consulting engineer of Portland, Ore., died there on February 27, 1944. Mr. Amburn, who was 79, had for many years maintained a consulting practice in Portland. One of the projects on which he was engaged was the construction of the Bull Run pipe line for the Portland water supply.

OTTO WILLIAM DEGEN (M. '10) retired engineer of Alameda, Calif., died suddenly at his home there on February 19, 1944. Mr. Degen, who was 79, spent practically his entire career as engineer and superintendent of construction for the Quartermaster Corps of the U.S. Army, stationed at Alameda. He retired in 1935.

WILLIAM GERIG (M. '02) retired civil engineer of Arkadelphia, Ark., died at his home there on April 3, 1944, at the age of 78. Mr. Gerig was assistant engineer for the Mississippi River Commission from 1890 to 1905; division engineer on the construction of Gatun Dam at the Panama Canal from 1905 to 1908; chief engineer of the Pacific and East Railroad from 1909 to 1915; and engineer in charge of the Anchorage division of the Alaskan Railroad from 1917 to 1923. In the latter year Mr. Gerig became connected with the Office of the Chief of Engineers, finally serving as head engineer in the Washington office. He retired in 1938.

GUSTAVE ADOLPH HANSON (M. '25) president and general manager of the G. A. Hanson Company, Inc., of Tampa, Fla., died on December 15, 1943. He was 49. From 1916 to 1919 Mr. Hanson was general superintendent of the Tampa Dock Company; from 1919 to 1920, with the Aberthaw Construction Company of Boston; and from 1920 to 1926, chief engineer for G. A. Miller, Inc., Tampa Builders. From the latter year on he headed the G. A. Hanson Company.

THOMAS EMMET LEAHY (M. '21) retired civil engineer, died in Canton, Ohio, on March 9, 1944, at the age of 67. Mr. Leahy retired in 1942 after many years as supervising engineer in the Quartermaster Corps of the U.S. Army. He supervised construction of several large government buildings, and from 1928 to 1933 was supervising engineer for the Barksdale (La.) airfield. Later he constructed other airfields in Texas. His last assignment was at Columbus, Ohio, where he was in charge of the construction of a storage depot for the Army Ordnance Department.

JOHN PATRICK MYRON (M. '20) vice-president and chief engineer for the F. B. Leopold Company, Inc., of Pittsburgh, Pa., died on March 21, 1944. Mr. Myron, who was 63, was for some years a member of the consulting firm of Hudson and Myron, with headquarters in Pittsburgh. He had also been secretary and general manager of the Pittsburgh Filter and Engineering Company. In 1931 he became connected with the F. B. Leopold Company, Inc.

GEORGE ALEXANDER ORROK (M. '06) consulting engineer of New York, N.Y., died at his home at Riverside, Conn., on April 6, 1944, at the age of 77. Mr. Orrok had made important research contributions in the field of heat transfer, in condensers and furnaces. In 1898 he joined the New York Edison Company as a draftsman, and nine years later was appointed mechanical engineer. From 1914 to 1928 he was consulting engineer for the company, serving as consultant on many of the company's large power stations and hydroelectric projects. Since 1928 he had been associated with David M. Myers and Willam A. Shoudy in independent consulting practice.

GIFFORD LAWSON OSBORNE (Assoc. M. '36) lieutenant (jg), U.S. Coast Guard Reserve, died in Honolulu, Hawaii, on March 3, 1944. In a few days he would have been 46. A veteran of the first World War, Lieutenant Osborne went to Honolulu in January 1941 in a civilian capacity with the Coast Guard. He received his commission in February 1943. Before going to Hawaii he had been county engineer of Wahkiakum County, Washington, and had maintained an engineering practice at Cathlamet, Wash.

ARTHUR EDMUND OWEN (M. '19) chief engineer of the Central Railroad of New Jersey, died in a hospital at Bound Brook, N.J., on March 21, 1944. He had been stricken a few hours earlier on a train en route from the Jersey City offices of the Central Railroad to his home at Abington, Pa. Mr. Owen, who was 68, had been connected with the Central Railroad of New Jersey for forty-five years—for twenty-seven years as chief engineer. Simultaneously, for part of this period, he was also chief engineer for the Reading Railroad.

JOHN RICHARDS PILL (M '13) manager of the land department of the Woodward (Ala.) Iron Company, died in Birmingham, Ala., on January 28, 1944. Mr. Pill, who was 77, was born in England and gained his early engineering experience in Newfoundland. He then came to the United States, where he was assistant engineer for the Southern Railway (1894 to 1901) and chief engineer and general superintendent of the Galloway Coal Company (1901 to 1908). Beginning in 1909 he was for a number of years president of the Birmingham Fuel Company.

ALFRED MERRITT QUICK (M. '10) chief engineer for the U.S. Fidelity and Guaranty Company of Baltimore, Md., died on March 31, 1944, at the age of 77. During Mr. Quick's administration as water engineer of Baltimore (1900 to 1911), plans were drawn for enlarging the Loch Raven Dam and for building the filtration plant. He was first to use the chlorine method of disinfecting a city's water supply. For some years Mr. Quick maintained a consulting practice in Baltimore, and for the past twenty years had been chief engineer for the U.S. Fidelity and Guaranty Company.

FRANKLIN HENRY ROBBINS (M. '29) who retired last year as designing engineer for the New York City Board of Water Supply, died at his home there on March 12, 1944. His age was 72. Mr. Robbins' early work was with engineering firms engaged in constructing water works in Boston and Pittsburgh. In 1907 he joined the staff of the Board of Water Supply, which was then engaged on the construction of the Catskill Aqueduct. In 1917 he was made designing engineer.

(SIR) THOMAS ROBERT JOHN WARD (M. '16) retired engineer of Hatch End, Middlesex, England, died recently at the age of 81. Born in South Africa, Sir Thomas was educated in England and then returned to South Africa, where he was engaged for a time in diamond and gold mining. Later he went to India, where he spent many years. He designed and constructed an irrigation system for Punjab and became chief engineer of Punjab and inspector general of irrigation in India. He also inaugurated an irrigation system for Siam, and had advised on irrigation developments in Iraq, Brazil, and the Argentine. He retired in 1935 and returned to England.

WILLIAM SIDNEY WOLFE (Assoc. M. '19) since 1926 chief structural engineer for Smith, Hinchman and Grylls, architects and engineers of Detroit, Mich., died in that city on February 10, 1944. He was 54. Early in his career Mr. Wolfe taught at his alma mater, the University of Illinois. During this period he prepared a book, *Graphical Analysis*, that became a standard text. At the outbreak of the first World War he became connected with the Emergency Fleet Corporation and was stationed in Philadelphia. In 1919 he went to Detroit to join the staff of Smith, Hinchman and Grylls, where he remained for the rest of his life except for a two-year period as chief engineer for the Gabriel Steel Company, of Detroit.